TECHNICAL DATA BASE STUDY
WESTERN BRANCH WATERSHED
PRINCE GEORGE'S COUNTY, MARYLAND

Prepared by:

The Prince George's County
Stormwater Management Technical Group
County Administration Building
Upper Marlboro, Maryland 20772

Edited and Prepared for Publication by:

The Environmental Planning Division,
Maryland National Capital Park and
Planning Commission
County Administration Building
Upper Marlboro, Maryland 20772

TABLE OF CONTENTS

TABLES

EXHIBITS

EXHIBIT 1. FLOOD PROFILES

WESTERN BRANCH MAIN STEM

FOLLY BRANCH

LOTTSFORD BRANCH

BALD HILL BRANCH

NORTHEAST BRANCH

SOUTHWEST BRANCH

TURKEY BRANCH

CABIN BRANCH

BACK BRANCH

FEDERAL SPRING BRANCH

EXHIBIT 2. FLOOD HAZARD BOUNDARY MAP INDEX

EXHIBIT 3. FLOOD HAZARD BOUNDARY MAP

Storm Water Management Task Force

Kenneth M. Duncan, Chief Administrative Officer, Chairman
Robert McGarry, General Manager, Washington Suburban Sanitary Commission
John F. Downs, Jr., County Planning Director, Maryland-National Capital Park and Planning Commission
Samuel E. Wynkoop, Council Administrator, County Council
Vaughn Barkdoll, Director, Department of Public Works and Transportation
William Gullett, Director, Department of Licenses and Permits

Storm Water Management Technical Committee

Dave Bourdon, District Manager, Prince George's County Soil Conservation District
Donald Chapman, Department of Public Works and Transportation
Charles Hancock, District Conservationist, Prince George's County Soil Conservation District
William McMahon, Department of Licenses and Permits
Diane Page, Washington Suburban Sanitary Commission
Stan Udhiri, Maryland-National Capital Park and Planning Commission

Storm Water Management Technical Group

Project Director

Stan Udhiri, P.E., Chief, Environmental Planning Division, M-NCPPC

Project Staff

K. D. Nambudripad, P.E., Project Engineer/Manager, M-NCPPC
Martin Wallace, Project Engineer, Washington Suburban Sanitary Commission
Mulraj Vasa, P.E., Project Engineer, Department of Public Works and Transportation
Kirk Lamartin, Project Water Resources Planner
Michael Cringoli, Project Water Resources Planner
Dominic Motta, Principal Environmental Planner
Frank Galosi, Project Water Resources Planner
Frances Guertin, Project Secretary

Technical Assistance

William Limpert, Water Resources Planning Assistant
Edward Bourgondien, Drafting Supervisor
George Clark, Drafting Technician
Fran Heflin, Word Processing Operator III

Summary of Findings

FLOODING

Based on existing land use, a total of 58 residences, 89 garages/sheds, 79 commercial establishments, 1 school and 2 recreation facilities are wholly or partially within the floodplain and most of these structures are located along Bald Hill Branch and the main stem of Western Branch (Table 9). A total of 229 structures with an assessed value of twenty-five million dollars ($25,000,000.00) have been identified as flood prone. (Assessed value was obtained from tax assessor's files and in most cases is significantly lower than a structure's replacement value.) The development of the watershed in accordance with adopted and approved comprehensive zoning plans would cause 74 additional structures to become flood prone, (a total of 99 residential, 110 garages/sheds, 89 commercial, 1 school, and 4 recreational facility structures (Table 10).

In a worst case scenario, during a 100 year flood event with major structural damage to residences and commercial establishments, losses in the county could exceed fifteen million dollars* ($15,000,000.00) under existing development and twenty-one million dollars* ($21,000,000.00) in the future. No attempt has been made to assign monetary values to loss of life, discomfort, displacement, dislocation, road wash-out, social disorder, relief efforts, restoration of public services and the loss of a sizeable tax base. The loss figures stated are therefore rough approximations and the toll in an actual event could be much higher.

EROSION AND SEDIMENTATION

The total annual erosion rate from Western Branch Watershed based on our analysis, is approximately 535,208,000 pounds per year or 12,200 pounds per acre per year for existing land use condition. This translates to approximately 115 acre-feet of valuable agricultural and gardening top soil wastage yearly.

Top soil is humus formed by the mixture of soil with decomposed organic matter. It is present at the very top of soil strata or horizons which is usually called the A horizon. The soil horizon contains most of the nutrients that a plan's ecosystem needs for survival. Erosion of this horizon with its valuable plant nutrients results in heavy dosages of fertilizer application which eventually wash off into streams, triggering water quality problems.

---

*Loss figures were computed based on estimated average loss value of fifty thousand dollars ($50,000.00) for residential, two thousand dollars ($2,000.00) for a garage/shed, one hundred and fifty thousand dollars ($150,000.00) for a commercial, one hundred thousand dollars ($100,000.00) for a school and ten thousand dollars ($10,000.00) for a recreational facility structure.

Sediment yield in the watershed is approximately 72,338,000 pounds per year. This is equivalent to filling a 12-acre lake with 1.5 feet of sediment annually. Tables 11 and 12 show various rates of erosion and sediment yield from different land uses under present and future land use conditions.

A survey of the streams within Western Branch identified pockets of moderate to severe erosion activity, large areas of sediment deposits and debris collection. Additional areas with high erosion and sediment yield potential were identified from a simulation of the watershed's response to future land use patterns. These areas are identified in the report.

WATER QUALITY

The overall water quality of Western Branch can be rated as "good", with "excellent" readings for Dissolved Ozygen and pH. Periodic problems do occur with respect to Fecal Coliform levels, particularly druing the spring and summer seasons. These problems likely result from a variety of origins including urban runoff, agricultural runoff and overloaded septic tanks. Point source discharges are not a major problem within the watershed. With increasing development, non-point pollution from urban runoff will become an increasing concern. An analysis of present and future land uses within the Basin indicate that non-point pollutant loading will increase significantly in the future.

CONSERVATION AREAS

An inventory of the Wildlife, Wetlands, Parklands, Historic Sites, and Archeological Sites has been compiled and included in this report.

This Study was performed by an inter-agency technical group made up of Water Resources Planners/Engineers from Prince George's County Department of Public Works and Transportation, the Washington Suburban Sanitary Commission and the Maryland-National Capital Park and Planning Commission.

Western Branch Watershed
Technical Data Base Report

1.0 INTRODUCTION

This report contains the hydrologic, hydraulic and environmental features data generated during the study. Survey and other pertinent background information are on file in the Environmental Planning Division of the Maryland-National Capital Park and Planning Commission, County Administration Building, Upper Marlboro, Maryland.

1.1 Background

In May 1976, the Chairman of the Prince George's County Council requested the County Executive to develop a coordinated and unified approach to the fragmented issue of storm water management activities in the County. The County Executive in October of the same year created a department head level Task Force of various agencies at the County and State levels, chaired by the Chief Administrative Officer. After several months of briefing sessions regarding the activities, responsibilities and philosophies of the various agencies, a Task Force report (Reference 1) was prepared and transmitted to the County Council. Among the recommendations of the Task Force as approved by the County Council in July 1977 were: the creation of an inter-agency Technical Group with representatives from the Washington Suburban Sanitary Commission (WSSC), Prince George's County Department of Public Works and Transportation (DPW&T), and the Maryland-National Capital Park and Planning Commission (M-NCPPC) to prepare Basin Plans for all major watersheds in the County and the preparation of a Comprehensive Storm Water Management Plan. The Technical Group was formed in December 1977, under the general guidance of the Storm Water Management Technical Committee.

1.2 Authorization

This study was authorized by the Prince George's County Council as part of the FY 80 work program on Storm Water Management. The contract agreements between the various County agencies dated October 19, 1979, form the basis for this work. Funding for the program was provided by the WSSC from their Storm Drain Maintenance Accounts, and transferred to M-NCPPC and the County through the aforementioned contracts.

1.3 Purpose of Study

The purpose of this study is to identify through hydrologic and other analyses, the existing and future watershed problems relating to flooding, erosion, sedimentation, water quality, wetlands and other environmental features.

2.0 WATERSHED DESCRIPTION

2.1 Location and Size

Western Branch, a tributary of the Patuxent River is located in the central portion of Prince George's County, Maryland, and lies wholly within the Atlantic Coastal Plain Physiographic province in Maryland. It drains approximately 22 percent of the County and has a total watershed area of 110 square miles. Included within the scope of this study is the entire Western Branch watershed upstream of its confluence with Charles Branch. The study area (69.53 square miles) does not include the area drained by Collington Branch -- a major tributary of Western Branch. Collington Branch was studied separately. The area of study is shown on the vicinity map (Figure 1).

The headwaters of the Western Branch watershed comprises Bald Hill, Folly and Lottsford Branches. Bald Hill Branch originates just north of Greenbelt Road within the Goddard Space Flight Center. Along most of its 5.9 mile length and 5.7 square mile drainage area, the stream has a very flat gradient with large areas of overbank ponding. The channel is improved for a distance of approximately 1,000 feet downstream of Good Luck Road and concrete-lined from the Penn-Central Railroad crossing to a point approximately 250 feet downstream of Annapolis Road. Folly and Lottsford Branches converge approximately 4,000 feet upstream of Lottsford's confluence with Bald Hill to form Western Branch.

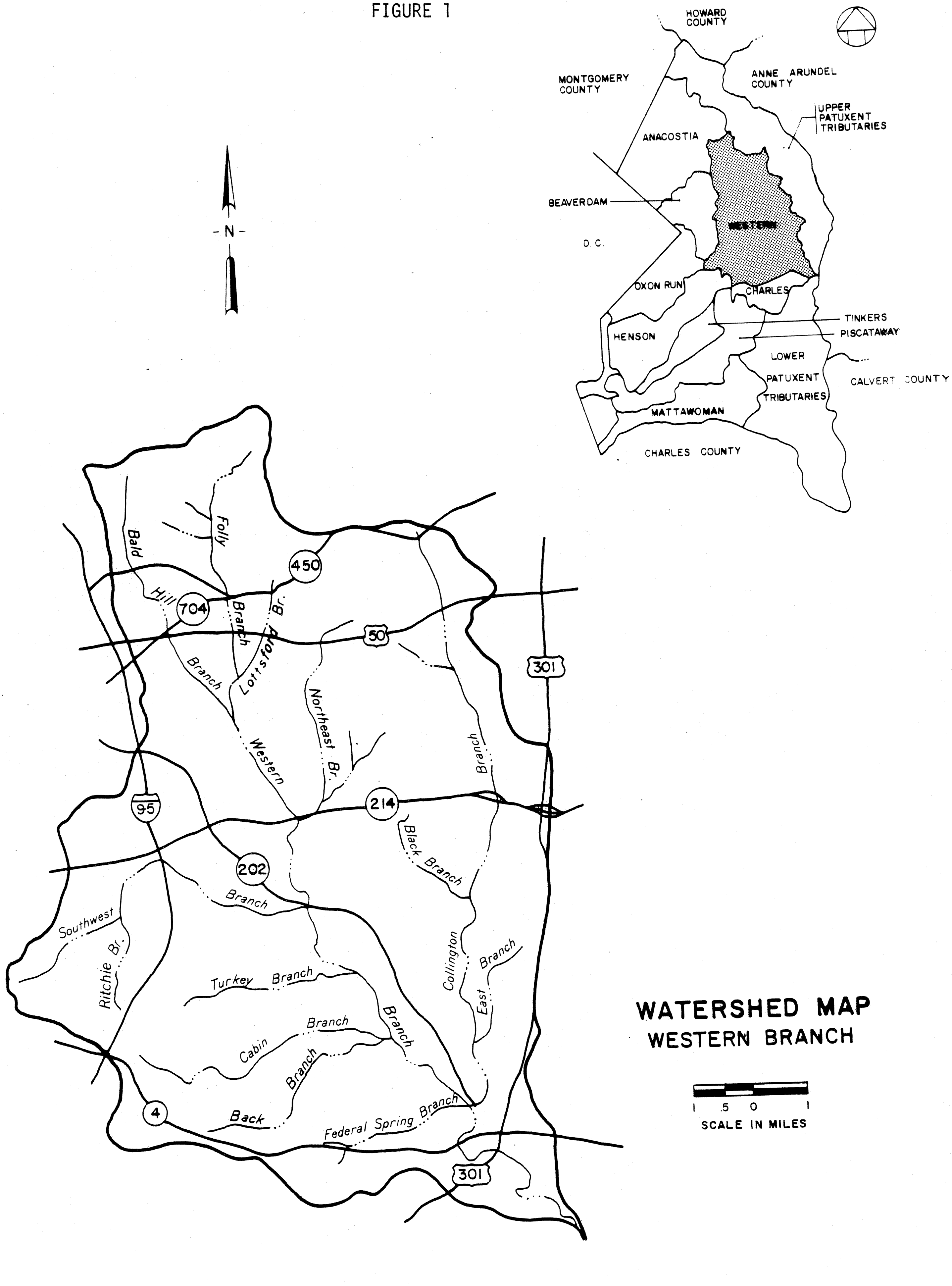
Folly Branch, with a drainage area of 6.2 square miles, rises northeast of the intersection of Lanham-Severn and Greenbelt Roads. For most of its 5.3 miles length this branch has an extremely flat gradient with a wide, swampy and ill-defined channel. However, between Lanham-Severn and Glenn Dale Roads, the channel is well defined.

Lottsford Branch flows for a distance of approximately 3.4 miles from its headwaters, northwest of Bell Station Road and mocking Bird Lane. This Branch has a drainage area of 2.7 square miles, upstream of the confluence with Folly Branch and a drainage area of 9.3 square miles at the confluence with Bald Hill Branch. Lottsford Branch also has an extremely flat stream gradient.

Western Branch, from the confluence of Lottsford and Bald Hill Branches, flows for approximately 16.5 miles, following a winding course along a flat stream gradient. Before emptying into the Patuxent River, a mile above Jug Bay, several major tributaries flow into it. These are:

- Northeast Branch which originates between Enterprise and Bell Station Roads, and flows into Western Branch from the east, just

FIGURE 1


HOWARD COUNTY
MONTGOMERY COUNTY
ANNE ARUNDEL COUNTY
UPPER PATUXENT TRIBUTARIES
ANACOSTIA
BEAVERDAM
D. C.
OXON RUN
CHARLES
TINKERS
PISCATAWAY
HENSON
LOWER PATUXENT TRIBUTARIES
CALVERT COUNTY
MATTAWOMAN
CHARLES COUNTY
N
Bald Hill Branch
Folly Branch
Lottsford Br.
Branch
450
704
50
301
Northeast Br.
Western
Branch
214
95
202
Black Branch
Branch
Southwest
Ritchie Br.
Turkey Branch
Collington
East Branch
Cabin Branch
Branch
Back Branch
Federal Spring Branch
4
301
WATERSHED MAP
WESTERN BRANCH
1 .5 0 1
SCALE IN MILES

south of Route 214. It has a drainage area of approximately 8.8 square miles, and an average slope of 17.5 feet/mile.

- Southwest Branch which flows into Western Branch from the west just south of Route 202. It has a drainage area of approximately 15.4 square miles including Ritchie Branch, and an average slope of 24.9 feet/mile. Southwest Branch originates inside the Capital Beltway, in the area of District Heights.

- Turkey Branch which flows into Western Branch from the west near the western boundary of the University of Maryland Tobacco Experimental Farm. It has a drainage area of approximately 2.0 square miles, and an average slope of 56.4 feet/mile. Turkey Branch originates just east of the intersection of Sansbury and D'Arcy Roads.

- Cabin Branch, which originates just northeast of Andrews Air Force Base and converges with Western Branch from the west approximately 2.3 miles upstream of Main Street in Upper Marlboro. It has a drainage area of 5.7 square miles, and an average slope of 12.2 feet/mile.

- Back Branch, a tributary of Cabin Branch, joins it from the Southwest just west of Brown Station Road. It has a drainage area of 2.8 square miles, and an average slope of 36.4 feet/mile. Back Branch originates northwest of the intersection of Melwood Road and Old Marlboro Pike.

- Federal Spring Branch which converges with Western Branch from the west just upstream of Main Street. It has a drainage area of 3.9 square miles, and an average slope of 32.0 feet/mile. Federal Spring Branch originates southeast of the intersection of William Beanes and Osborne Roads.

The Western Branch watershed receives an average of 44 inches of rainfall and 20 inches of snowfall a year. The area is subject to intense thunderstorms during the summer months and hurricane type storms in the late summer and early fall (Reference 2).

2.2 Soils

The upper part of the watershed consists of the Christiana-Sunnyside-Beltsville soil association. These are deep, level to steep, well-drained, sandy and clayey soils and level to sloping, moderately deep, moderately well drained soils that have a compact subsoil. The middle portion consists mainly of Collington-Adelphi-Monmouth association - deep, nearly level to strongly sloping, well drained to moderately well drained soils of the uplands that developed in sediments containing glauconite. The majority of the lower portion contains Westphalia-Evesboro-Sassafras association - deep, well-drained to excessively drained soils of the uplands that are mostly moderately sloping to steep. Most of the flood plain areas are of the Bibb-Tidalmarsh association - poorly drained soils of the flood plains and soils in marshes that are subject to tidal flooding. There are small pockets of Beltsville-Leonardtown-Chillum, Collington-Matapeak-Galestown and Westphalia-Marr-Howell associations.

Based on the Soil Conservation Service Classification (Reference 3) the watershed consists mainly of hydrologic soil group B. This soil group has moderate infiltration rates when thoroughly wet. Soil Group A with a high infilration rate covers 6% of the watershed. Soil Group C primarily in the middle portions of the watershed occupies 12% of the area. Soil Group D is found mainly in the flood plains and near the headwaters of Southwest Branch. This soil group with a slow infiltration rate when thoroughly wetted occupies approximately 19 percent of the drainage area.

2.3 Development in the Watershed

Approximately 10 percent of the Western Branch Watershed lies inside the Capital Beltway (I-95). This area is extensively developed, and includes District Heights, Forestville and Hampton Park areas. Outside the Beltway the northern portion of the watershed is heavily developed and consists of mixed land uses. The New Carrollton, Seabrook and Lanham areas are predominantly residential but have several commercial and a few industrial developments. The central portion of the watershed has considerable new residential developments which include Kettering, Kingsford, and Northampton.

The eastern portion is mostly undeveloped with some residential development. Most of the residential development has occurred within the past 15 years. The principal development is the Belair extension of the City of Bowie. A major employment center bounded by Route 214, Leeland Road, Route 301 and the Collington Branch floodplain is being developed by the County.

The County Seat is located in Upper Marlboro, approximately 5 miles above the mouth of Western Branch. In addition, the town of Upper

Marlboro is the hub of local tobacco trading activities and warehouses and also has some older residential neighborhoods.

The extent of urbanization in the various tributary watersheds is shown in Table 1.

Table 1

EXTENT OF URBANIZATION IN WESTERN BRANCH

Tributary	% Urbanized
Folly	29
Lottsford	15
Bald Hill	43
Northeast	9
Southwest	33
Turkey	9
Cabin	11
Back	10
Federal Spring	7
Western - TOTAL	18

Table 2 shows the approximate distribution of various land uses within the watershed. The acreage under construction was obtained using 1977 and 1978 aerial photographs of the area, supplemented with data from grading permits and field checks.

Table 2

LAND USE DISTRIBUTION IN WESTERN BRANCH

Land Use Category	Area in Acres	% of Total
Agriculture	7,042	15.8
Pasture	2,236	5.0
Grassland (Open Space, Meadow)	8,591	19.3
Woodland	17,335	39.0
Commercial	920	2.1
Industrial	688	1.5
Residential		
1/8 Ac. Lots	731	1.6
1/4 Ac. Lots	1,958	4.4
1/3 Ac. Lots	29	0.1
1/2 Ac. Lots	1,996	4.5
1 Ac. Lots	941	2.1
Paved	616	1.4
Gravel Parking/Dirt Road	43	0.1
Construction	571	1.3
Land Fill	273	0.6
Gravel Pit	74	0.2
Lakes, Ponds, Marshes	456	1.0
Total	44,500 (69.53 sq. mi.)	100.0

3.0 PROBLEMS WITHIN THE WATERSHED

Periodic flooding from stream overflow occurs along most of the main stem and tributaries. There have been reports of frequent flooding of commercial and residential properties along Lanham-Severn Road, Wellington Place, 4th, 5th and 6th Streets adjacent to Bald Hill Branch. On Southwest Branch, roads are frequently closed by flood water and some residential and commercial developments were built on flood prone land. Several road crossings on the main stem and the tributaries of Western Branch are affected for many hours each year due to overtopping.

Erosion of stream banks and general environmental degradation are evident in many parts of the watershed.

4.0 FLOOD PROTECTION MEASURES

In 1964, a local flood control channel and levee system were constructed along Western Branch near the Town of Upper Marlboro to contain flood flows. The Washington Suburban Sanitary Commission has channelized some stream segments within the watershed to minimize the flooding incidences. In addition, local channelization projects performed in connection with bridge replacement schemes have alleviated flooding at several previously flood prone road crossings, especially along Southwest and Bald Hill Branches.

5.0 SCOPE OF STUDY

The main stem of Western Branch and the tributaries listed in Table 3 were studied in detail.

Table 3

TRIBUTARIES STUDIED IN DETAIL

Stream	Drainage Area	Extent of Study
Folly Branch	6.2	From Headwaters to Confluence with Lottsford Branch
Bald Hill Branch	5.7	From Headwaters to Confluence with Folly Branch
Lottsford Branch	9.3	From Headwaters to Confluence with Bald Hill Branch
Northeast Branch	8.8	From Headwaters to Confluence with Western Branch
Southwest Branch (including Ritchie Branch)	15.4	From Headwaters to Confluence with Western Branch
Turkey Branch	2.0	From Headwaters to Confluence with Western Branch
Cabin Branch	5.7	From Headwaters to Confluence with Back Branch
Back Branch	2.8	From Headwaters to Confluence with Cabin Branch
Federal Spring Branch	3.9	From Headwaters to Confluence with Western Branch

Collington Branch, a major tributary of Western Branch was studied separately. Charles Branch, which drains into Western Branch just upstream of the Patuxent River Confluence will be studied separately.

6.0 STUDY METHODOLOGY

For all the flooding sources studied in detail, standard hydrologic and hydraulic methods were used to determine the effect of the 2-, 10-, 100, and 500-year floods. These floods were selected as having special significance in storm water management and the 100 year flood has been adopted as the standard for identifying special flood hazard areas and developing local land use controls consistent with Federal Insurance Administration guidelines. The analyses were based on present and future development conditions.

6.1 Hydrology

Hydrologic analyses were performed to determine the discharge values, volumes and times of their occurrence at different points within the watershed for the stated recurrence intervals. The determinations were made, using a hydrologic computer model developed by the Soil Conservation Service (Reference 4).

This computer model uses a dimensionless triangular unit hydrograph which has a 37.5 percent of the total volume on the rising side, with a built-in peak rate factor of 484 (Reference 3). This factor, however, could vary from about 600 in steep terrain to 300 in very flat swampy areas (Reference 3).

Most of the streams within the Western Branch watershed with the exception of Southwest Branch have flat gradients and are sluggish. The overbank areas are also flat and, in many sections marshy. Analysis of several natural hydrographs in the area obtained from the U.S. Geological Survey show the rising side with 23 percent of the total volume. A corresponding change in the peak rate factor from 484 to 300 in the model was made to reflect this smaller percent of volume under the rising side. This compares favorably with a 284 peak rate factor developed for the eastern shores of Maryland (Reference 5). A peak factor of 300 was used in this model representation with the concurrence of a Soil Conservation Service hydrologist in Broomall, Pennsylvania. (Reference 6)

The watershed was divided into 272 sub-areas ranging in size from 19 acres to 520 acres. Discharges were generated for each of these sub-areas using the 24 hour Type II rainfall distribution, typical of regions east of the Rocky Mountains, and Antecedent Moisture Condition II (AMC II) indicating average soil moisture conditions prior to the main rainfall event. (Reference 3).

Existing land use information was obtained from recent aerial photographs, building, Use and Occupancy Permits, and field surveys. The future land use condition was determined from the various adopted and approved comprehensive rezoning maps of the area: Where a zoning map was not available, guidance was sought from the Area Master Plan.

Routed discharge flow values to specific locations on the streams for floods of the specified recurrence intervals are shown in Appendix A.

6.2 Validation of Discharge Values

The peak discharge values obtained for present land use conditions using the TR-20 computer program were compared with values developed by other generally acceptable hydrologic techniques. These techniques include: (a) Statistical analysis of stream gauge data from station records on Western Branch near Largo and on Northeast Branch of Anacostia River near Riverdale, (b) transposition of flow data from other gauged watersheds with physical, hydrologic and meteorological characteristics similar to Western Branch, (c) drainage area - discharge-frequency relationships from similar watersheds in the region and (d) regression equations.

Statistical Analysis:

The U.S. Geological Survey maintained a stream gauging station on Western Branch approximately 200 feet upstream of Largo Road from 1949 to 1974. The gauge had a drainage area of 30.2 square miles. This gauging station was discontinued due to the unreliability of the stage-discharge relationship obtained from it. From 1949 to 1974, Western Branch Watershed underwent a transformation from a rural to a suburban area, resulting in increased impervious land cover, storm drain sewerage, and greater storm runoff for a given amount of precipitation. The changed land use and resultant runoff increases created a measure of non-homogeneity within the population of runoff values at the Largo Road gauging station. To homogenize the population, the 25 years of record were segmented into 3 horizons of similar development activity in the region - 1949 to 1960, 1961 to 1968 and 1969 to 1974. The effect of development to year 1979 on each horizon's flow was assessed, thereby reducing all flow values to a common developmental period base. The homogenized flows were distributed using a Log-Pearson Type III curve (Reference 7). A comparison of TR-20 values and those obtained using the Log-Pearson Type III distribution is made in Table 4.

Table 4

COMPARISON OF "TR-20" AND LOG-PEARSON TYPE III" VALUES
AT THE LARGO GAUGE

Recurrence Interval (Years)	Log-Pearson Type III Peak Discharge cfs	Log-Pearson Type III Peak Discharge (cfs) Adjusted for Urbanization	T.R.-20 Peak Discharge (cfs)
2	914	1800*	1220
10	1475	3687*	3400
100	2411	4822	7435
500	3251	6502+	10675

* Ratios for these values obtained either by interpolation or extrapolation
\+ Ratio used for value, same as the 100 year ratio

Column 3 was obtained by adjusting the log-Pearson Type III peak discharges for the effects of urban and suburban development using flood-peak-magnitude ratios of developed basins to natural basins (Reference 8).

Also three gauged streams with similar hydrologic and physical characteristics were analyzed. Data from these watersheds were distributed using a Gamma function (Reference 8). The result of the analyses was compared with the TR-20 values for Western Branch in Table 5.

Table 5

COMPARISON OF PEAK DISCHARGE VALUES FROM HYDROLOGICALLY SIMILAR WATERSHEDS

Watershed	Drainage Area Sq. Mi.	Peak Drainage cfs	Method of Computation
Northeast Branch (Anacostia River) at Riverdale, Maryland	72.80	13,764	Log-Pearson Type III
Mattawoman Creek near near Pomonkey, Maryland	57.70	12,700	Log-Pearson Type III
South Branch, Patapsco River at Henrytown, Maryland	64.40	12,600	Log-Pearson Type III
Western Branch above Collington	65.64	13,560	T.R - 20

Drainage Area-Discharge-Frequency Relationship:

This technique involves the use of discharge-drainage area-frequency relationships developed for Watersheds with similar hydrologic characteristics. Such relationships have been developed for the Anacostia Watershed in a technical study utilizing the gauge records at Colesville and Hyattsville, Maryland (Reference 9). Discharge values obtained from the Northeast Branch were used for the analytical comparison since the Northeast Branch lies mostly in the Coastal Plain Province with characteristic sluggish stream reaches and wide flood plains. The Northwest Branch on the other hand lies within the Piedmont Physiographic Province with its narrow, steep and rock stream channels. The comparative results are summarized in Table 6.

Table 6

DISCHARGE VALUES BASED ON DISCHARGE - AREA - FREQUENCY RELATIONSHIPS

Location	Drainage Area (Sq.Mi.)	Peak Discharge (cfs) by Ref. 9	Peak Discharge (cfs) by T.R-20
Near Largo gauge	30.20	7,977	7435
Above Collington Branch	65.64	13,338	13,565
At Mouth	92.40	15,957	16,835

Regression Equation:

Discharge values estimated using Anderson's regional regression equations (Reference 10) were compared with values from this study. The comparative values are tabulated in Table 7.

Table 7

COMPARISON OF DISCHARGE VALUES BY "ANDERSON" AND "TR-20"

Location	Drainage Area (Sq.Mi.)	Peak Discharge (cfs) by "Anderson"	Peak Discharge (cfs) by "T.R-20"
Folly Branch (Mouth)	6.2	3500	1340
Lottsford Branch (Above Folly)	2.7	1030	1110
Bald Hill (Mouth)	5.7	3100	1735
Northeast (Mouth)	8.8	3550	4335
Southwest (Mouth)	15.4	7115	6930
Turkey (Mouth)	2.0	1380	1065
Cabin (Above Back Branch)	5.7	2590	3430
Back (Mouth)	2.8	1660	1590
Federal Spring (Mouth)	3.9	2140	1780
Western at Mouth	*92.1	19560	16835

The 100-year discharge values computed using the TR-20 computer model compared well with those derived using other methods. The comparison in all cases was made using values determined based on present level of development. The values from this study in most cases are conservative and by extension it is our opinion that the ultimate development discharges are also conservative.

*Excluding Charles Branch

Area-Discharge-Frequency Relationship:

nique involves the use of discharge-drainage area-fre-
s developed for Watersheds with similar hydrologic char-
relationships have been developed for the Anacostia
nical study utilizing the gauge records at Colesville
ryland (Reference 9). Discharge values obtained from
ı were used for the analytical comparison since the
es mostly in the Coastal Plain Province with character-
am reaches and wide flood plains. The Northwest Branch
ies within the Piedmont Physiographic Province with its
ock stream channels. The comparative results are sum-

Table 6

BASED ON DISCHARGE - AREA - FREQUENCY RELATIONSHIPS

	Drainage Area (Sq.Mi.)	Peak Discharge (cfs) by Ref. 9	Peak Discharge (cfs) by T.R-20
	30.20	7,977	7435
ıch	65.64	13,338	13,565
	92.40	15,957	16,835

streams studied
vations of floods

from field
erts were
metry.

analysis were
ion. Roughness
035 to 0.07 for

HEC-2 step back-
mined for the 10-,

were obtained
Army Corps of

this study.

ion of actual
vations meaured at
ropical Storms
lations are shown

Table 8

ELEVATION VALIDATION

Location of Bridge/Culvert	Similated "AGNES" Discharge	Elev.	Measure Elev.	Simulated "ELOISE" Discharge	Elev.	Measured Elev.
Western Branch						
Old Crain Highway (Route 725)	7,294	22.8*	21.73		--	
Water Street	7,280	21.1*	20.1	11,310	23.8	22.08
Ritchie Branch						
Ritchie Road		--		750	161.0	158.63
Southwest Branch						
Ritchie Road		--		2,250	128.1	127.27
White House Road	3,490	57.0	57.95	4,290	57.5	58.35

* These computed elevations reflect the channel and floodplain clearing and modification done after the storms.

The elevations obtained from the simulation process are higher than the measured elevations by an average of 1.5 feet. The differences could be attributed to several reasons including measurements being taken on the rising or receeding segment of the flood hydrograph, rather than at its peak thus resulting in lower elevation measurements.

7.0 FLOODPLAIN MANAGEMENT

The 100-year flood has been adopted by the County as the base flood for purposes of flood plain management. The 100-year flood is the standard, adopted by virtually every Federal and State agency for flood plain control purposes as the feasible and realistic national standard, taking both flood perils and economic values into consideration. It is also the regulatory flood for the National Flood Insurance Program.

7.1 Floodplain Limits

The flood plain limits of the main stem and tributaries were established based on future development within the watershed in order to allow for growth without endangering the health, safety, and general welfare of the residents while minimizing the cost of providing storm drainage stystems in the County.

Small areas within the flood boundary may be above the 100 year flood elevation and therefore not subject to flooding; owing to scale limitations of the map, they maybe shown as flood prone.

8.0 STUDY FINDINGS

8.1 Flooding

. Folly Branch

Under existing land use, 10 residences, 9 garages/sheds, 4 commercial establishments and 1 school are within the 100 year flood plain. In the future, eleven additional residences and garages/sheds would become flood prone. The depth of flooding would range from 1 foot to 11 feet. One-half of the residential structures and all the commercial establishments are located upstream of the Conrail Railroad stream crossing. The existing culvert at this location does not have adequate capacity to convey flood flows and causes a significant backwater condition which results in flooding. Several structures and the school are located upstream of the abandoned Route 704 Road embankment downstream of the Conrail crossing. Constriction to flood flows by this embankment causes flooding in the Glenwood Park and Lincoln Subdivisions.

. Lottsford Branch

There are no residential or commercial structures identified either within the existing or future 100-year flood plain. Three (3) garages/sheds are now flood prone and 5 additional garages/sheds would be flood prone under future land use condition.

. Bald Hill Branch

Based on existing land use, 17 residences, and 14 garages/sheds, all located between Conrail Railroad Crossing and Tuckerman Street, are wholly or partially within the present 100-year floodplain. On the basis of future land use plans, 28 residences and 14 garages would be inundated to depths ranging from 0.5 feet to 4.5 feet. Flooding in this area is principally due to natural flood plain encroachment.

Table 9

Number of Flood Prone Structures by Tributaries

PRESENT (EXISTING) LAND USE

Tributary/ Branch Name	Residential	Garages & Sheds	Commercial	Schools	Recreational Facilities
Folly	10	9	4	1	0
Lottsford	0	3	0	0	0
Bald Hill	17	14	0	0	0
Northeast	0	7	1	0	0
Southwest	6	16	10	0	2
Turkey	0	1	0	0	0
Cabin	1	3	0	0	0
Back	0	2	0	0	0
Federal Spring	5	6	2	0	0
Western	19	28	62	0	0
Total	58	89	79	1	2

Table 10

Flood Prone Structures by Tributaries

FUTURE LAND USE

Tributary	Residential	Garage & Sheds	Commercial	Schools	Recreational Facilities
Folly	21	20	4	1	0
Lottsford	0	8	0	0	0
Bald Hill	28	14	0	0	2
Northeast	0	7	1	0	0
Southwest	20	16	12	0	2
Turkey	4	1	0	0	0
Cabin	1	4	0	0	0
Back	0	3	0	0	0
Federal Spring	6	6	2	0	0
Western	19	31	70	0	0
Total	99	110	89	1	4

. Northeast Branch

Based on existing and future land use, 7 garages/sheds and 1 commercial structure have been identified as flood prone. These structures are located downstream of the intersection of Central Avenue and Enterprise Road.

. Southwest Branch

A total of 34 structures consisting of 6 residences, 16 garages/sheds, 10 commercial establishments and 2 recreational facilities are in the flood plain under existing land use. Under future land use plans, 14 additional residences, and 2 additional commercial structures would become flood prone. The residential structures are located along the main stem of Southwest Branch and flood due to their proximity to the channel. The majority of the commercial structures are located in Hampton Mall which was built in the natural flood plain.

. Turkey Branch

Under future land use conditions, 4 residential structures, 3 of which are located upstream of Brown Station Road, and 1 shed would be subject to inundation, due to their proximity to the stream. However, flooding of these structures would be minor with water depth of approximately 0.2 feet. Under existing land use, only the shed is flood prone.

. Cabin Branch

One house on Ritchie-Marlboro Road has been identified as flood prone. This house, located in the middle of the flood plain would be inundated to a depth of approximately 2.2 feet under existing land use and 3.8 feet under future land use conditon. Three garages/sheds are presently flood prone and this number will increase to four in the future.

. Back Branch

There are no residential or commercial structures in the flood plain. Three sheds/garages are the only structures that would be affected by flood waters under future land use condition.

. Federal Spring Branch

Two residential buildings at the southwest corner of the intersection of Old Marlboro Pike and Ritchie-Marlboro Road and 1 garage/shed on the south side of Old Marlboro Pike approximately 800 feet west of the intersection with Ritchie-Marlboro Road are within the future 100 year flood plain. So also are 4 residences and 5 garages/sheds and 2 commercial structures on the south side of Old Marlboro Pike near the driveway to the Duke of Marlboro Country Club. Of these only 1 residential structure on the south side of Old Marlboro Pike near its intersection with Ritchie Marlboro Road is not susceptible to flooding based on existing land use condition.

. Western Branch (Main Stem)

A total of 70 commercial, 19 residential structures and 31 garages/sheds are within the 100-year flood plain based on future land use plans. Under existing land use conditions, 62 commercial, 19 residential structures and 28 garages/sheds are flood prone. Of the 120 structures identified as flood prone under future land use plans, 117 are located in the Upper Marlboro area and 3 in the Kettering Subdivision with depth of flooding ranging from 1 foot to 11 feet.

8.2 Erosion and Sedimentation

Estimates of the gross average annual erosion rates and sediment yields were made using the Universal Soil Loss Equation (USLE) for soil sheet and rill erosion caused by rainfall (Reference 8). This determination was then summed with estimates of stream bank erosion.

The total annual erosion rate from Western Branch Watershed based on our analysis is approximately 535,308,000 pounds per year or 12,200 pounds per acre per year for existing land use condition. This translates to approximately 115 acre-feet of valuable agricultural and gardening top soil wastage yearly.

Top soil is humus formed by the mixture of soil with decomposed organic matter. It is present at the very top of soil strata or horizons and is usually called the A horizon. This soil horizon contains most of the nutrients that the plant ecosystem needs for survival. Erosion of this horizon with its valuable plant nutrients results in heavy dosages of fertilizer application which eventually wash-off into streams, triggering water quality problems.

Table 11

EROSION AND SEDIMENTATION

(Present Land Use Conditions)

Land Use	Area (Acres)	%	Erosion Rate (T/Ac/Yr)	Annual Erosion (Tons/Yr)	Sediment Delivery Ratio (%)	Sedimment Yield (Tons/Yr)
Agriculture	7,033	16.0	8.4	58,941	11	6,483
Pasture	2,233	5.1	2.4	5,278	11	581
Woodland	17,312	39.4	0.32	5,488	11	604
Meadow	3,869	8.8	1.3	4,922	11	541
Open Space (good)	2,577	5.9	5.7	14,689	11	1,616
Open Space (poor)	2,131	4.9	31.6	67,327	11	7,408
Urbanized	7,906	18.0	1.9	15,021	60	9,013
Urbanizing	571	1.3	150.0	85,602	10	8,560
Landfill/ Gravel Pit	363	0.8	27.0	9,788	10	979
Streambank	69 mi.	N/A	7.9 T/mi.	548	70	384
TOTAL	44,043	100	6.1	267,604	13.5	36,169 (0.82 T/Ac/Yr)

Table 12

EROSION AND SEDIMENTATION

(Future Land Use Conditions)

Land Use	Area (Acres)	%	Erosion Rate (T/Ac/Yr)	Annual Erosion (Tons/Yr)	Sediment Delivery Ratio (%)	Sedimment Yield (Tons/Yr)
Agriculture	847	1.9	8.4	7,112	11	782
Pasture	388	0.8	2.5	838	11	92
Woodland	6,247	14.2	0.3	2,168	11	238
Meadow	496	1.1	1.2	580	11	64
Open Space (good)	809	1.8	9.3	4,770	11	525
Open Space (poor)	510	1.2	20.3	16,441	11	1,809
Urbanized	34,384	78.2	1.7	58,452	60	35,071
Urbanizing	N/A	N/A	N/A	N/A	N/A	N/A
Landfill/ Gravel Pit	363	0.8	26.5	9,606	10	961
Streambank	69 mi.	N/A	7.9 T/mi.	548	70	384
TOTAL	44,043	100	2.3	100,515	40	39,926 (0.91 T/Ac/Yr)

During the transition period between existing and ultimate development, the annual erosion rate will vary significantly since it is a function of construction activities. Tables 11 and 12 show various rates of erosion from different land use categories.

Sediment yields were also estimated using appropriate sediment delivery ratios for various land uses. For existing development condition, the sediment yield is approximately 72,338,000 pounds per year. This translates to filling a 12 acre lake (the size of Schoolhouse Pond) with 1.5 feet of Sediment annually. Under future land use conditions the yield from sediment will increase by 10 percent because of the high delivery ratios associated with urbanization (Table 12).

In addition to mathematical derivation of erosion rates and sedimentation yields, a survey of the streams within Western Branch, identified areas of moderate to severe erosion activity, large areas of sediment deposits and debris collection. Additional areas with high erosion and sediment yield potential were identified from a simulation of the watershed's response to future land use patterns. These areas are identified in this section by stream course.

. Folly Branch

The culverts under Palmer Highway and Route 450 are wholly or partially filled with sediments. At the Conrail crossing, a retaining wall for the sewer line back fill is unstable and failure seems imminent.

. Lottsford Branch

There is significant erosion and sedimentation due to construction activities in the vicinity of Glenn Dale Road Crossing. Erosion of the exposed slopes on the right overbank upstream of Glenn Dale Road has resulted in sediment deposition at the bridge waterway.

. Bald Hill Branch

On the downstream side of the Conrail crossing, the concrete channel is deteriorating and there is visible evidence of undermining. This structure could fail in the event of a flood of relatively large magnitude. On the upstream face of the Route 50 crossing, the left wing wall has separated from the headwall. A series of "Beaver Dams" are located downstream of Route 50 crossing and the pool of water behind the dams nearly fills the culvert cell under Route 50. The right embankment for the entrance ramp from Route 704 has caved in precariously close to the right wing wall on the downstream side of Route 50.

. Southwest Branch

At the Ritchie Road crossing, the right overbank is severely eroded and the channel in that general vicinity has sediment deposition of 1 to 2 feet. There is significant bank erosion along Waterford Drive upstream of Walker Mill Park. The erosion has progressed to several property lines in this area. Sedimentation and bank erosion activities are significant in the Hampton Park area. The concrete channel in the vicinity of Hampton Mall is deteriorating with severe erosion of the supporting overbanks. Significant channel bank erosion is also evident around the confluence of Southwest and Western Branches.

. Turkey Branch

The headwall on the upstream side of Brown Station Road is severely cracked and there is a potential for grave consequences in the event of a flood. The wingwall on the upstream side of Ritchie-Marlboro Road has separated from the base, and could result in structure failure. Turkey Branch upstream of Ritchie-Marlboro Road is clogged with debris, sediment and weeds. The right bank is severely eroded, causing a tree to topple in. The retaining wall at the upstream face of a driveway unto Ritchie-Marlboro Road, (approximately 1,250 feet northwest of where Turkey Branch crosses the road), is being undermined due to seepage and erosion. On the downstream side of the driveway, the retaining wall has caved in and the embankment is very unstable.

. Federal Spring Branch

There is significant erosion on the right bank behind the wingwall on the upstream side, and at the base of the wingwalls.

. Western Branch

At Routes 301, 202 and 4 road crossings, there is significant erosion of the stream banks and at Route 202 portions of the bridge piers and the bridge escapement under Route 4 are eroded. Sediment has partially clogged the bridge openings and this would effect the conveyance capacity of the structures.

8.3 Water Quality

The Prince George's County Health Department has monitored certain water quality constituents through a monthly grab-sample program on a periodic basis since 1973. Data were not collected during the 1979 calander year due to a lack of funding. Although other gaps exist in the data due to equipment malfunction, weather conditions and/or funding deficiencies, this sampling program represents the best water quality data base available for the Western Branch Watershed. Among the constituents sampled are Temperature, Dissolved Oxygen, pH and Fecal Coliforms. The location of sampling stations within the Western Branch Watershed is shown in Figure 4.

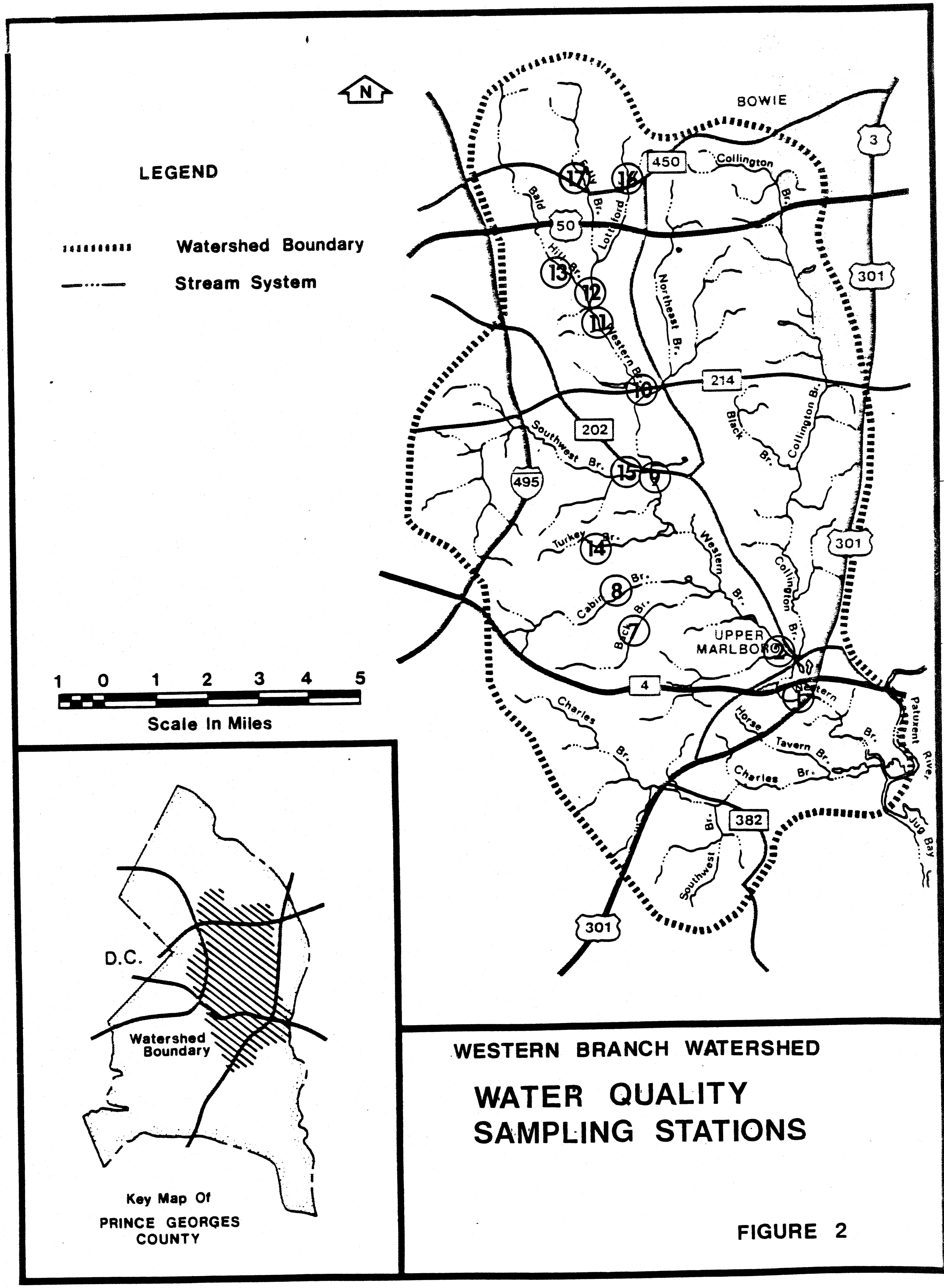
Data monitored on a "grab-sample" basis describe basic background conditions and provide an indication of trends over time and distance along the length of the stream bed. In order to enhance their value for analysis the data for Western Branch have been segregated into groups based upon the season in which the sample was taken. Using available data from 1976 through 1980, profiles were constructed over the length of the stream for Dissolved Oxygen (DO), pH and Fecal Coliforms (Figures 5, 6 and 7). In these figures, measured values are graphically compared with the following rating scale (Table 13) devised by the Metropolitan Washington Council of Governments (MWCOG) (Reference 13).

Table 13

WATER QUALITY RATING SCALE

Rating	Fecal Coliforms (MPN/100 ml)	Dissolved Oxygen (mg/l)	pH (su)
Excellent	< 200	> 8	6.9 - 8.0
Good	200 - 1000	7 - 8	6.5 - 6.9
Fair	1000 - 5000	4 - 6	5.5 - 6.5, 8.0 - 9.5
Poor	> 5000	< 4	< 5.5, > 9.5

The water quality of a stream typically reflects seasonal variations in temperature and flow. Frequently, water quality analyses



WESTERN BRANCH WATERSHED

WATER QUALITY SAMPLING STATIONS

FIGURE 2

emphasize the summer and early fall seasons when high temperatures and low flows may aggravate water quality problems. Depressed DO levels and high fecal coliform level which occur during the summer low flow period most often result from the direct discharge of wastes from point sources or from urban runoff following brief but intense rainstorms.

Winter and spring seasons are typically characterized by lower temperatures and higher flows. Depressed levels of DO are rarely a problem during this period due to the greater flows and higher natural DO saturation values. High fecal coliform levels can occur during these seasons due to urban and agricultural runoff and from hydraulically overloaded septic systems.

With these generalizations in mind the following deductions can be made based upon the data graphically represented in Figures 3, 4 and 5.

Dissolved Oxygen (DO)

With respect to DO, no serious problems were encountered along the length of the mainstem of Western Branch. Although a slight sag occurs between stations 10 and 12, DO levels generally remain in the exellent range even under summer conditions. The DO level does drop into the "good" range below Upper Marlboro. This drop in DO may be attributed to a number of reasons including tidal influence, wide shallow channel and the impact of development. The generally good to excellent levels of DO along the mainstem of Western Branch indicates that the direct discharge of oxygen demanding wastes is not a serious problem in the watershed.

DO levels in the "poor" range were measured only at Station 17 on Folly Branch. DO levels at this station are consistently lower than in other parts of the watershed. There is, however, no evidence of direct pollution above this sampling point and this site has the lowest Fecal Coliform levels in the watershed. An inspection of Station 17 indicates that extensive wetlands occur immediately upstream. Due to large accumulations of organic matter and poor circulation, depressed levels of DO are typical of such environments. For these reasons, low DO levels at Station 17 are probably naturally occurring.

pH

Measured levels of pH are consistently in the good to excellent range with little variation from season to season or from station to station.

FIGURE 3: WATER QUALITY PROFILE DISSOLVED OXYGEN

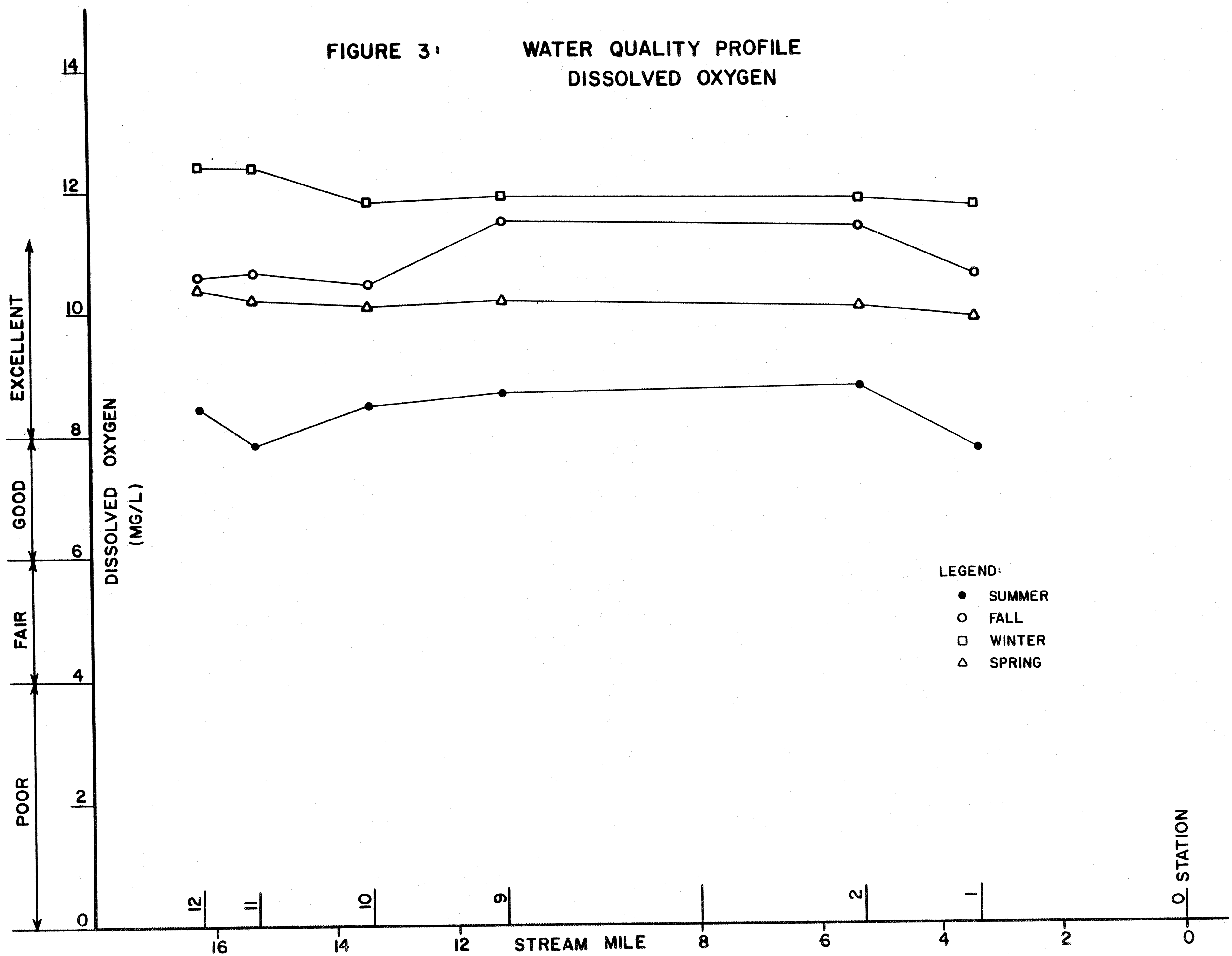


FIGURE 4: WATER QUALITY PROFILE

PH

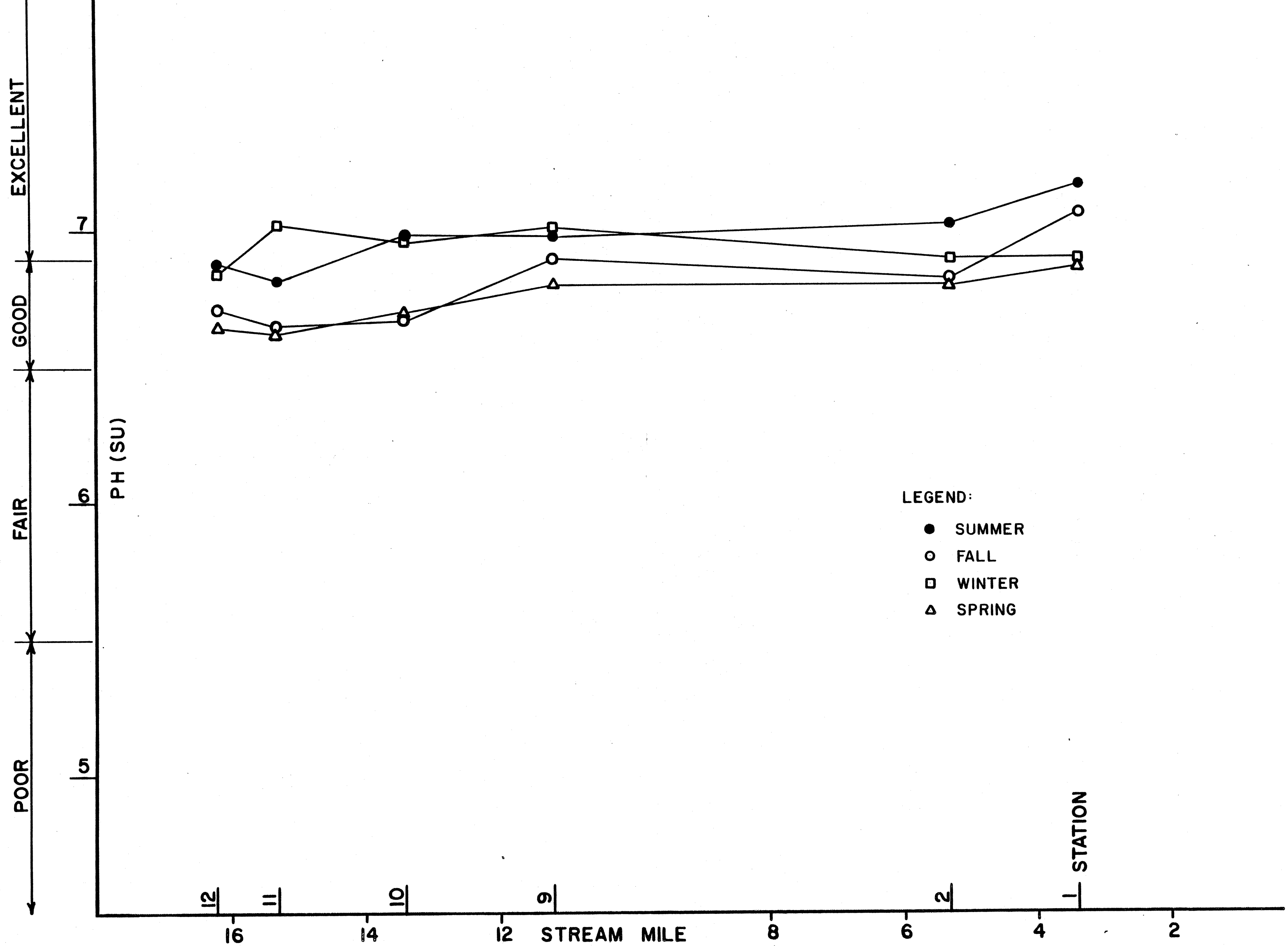
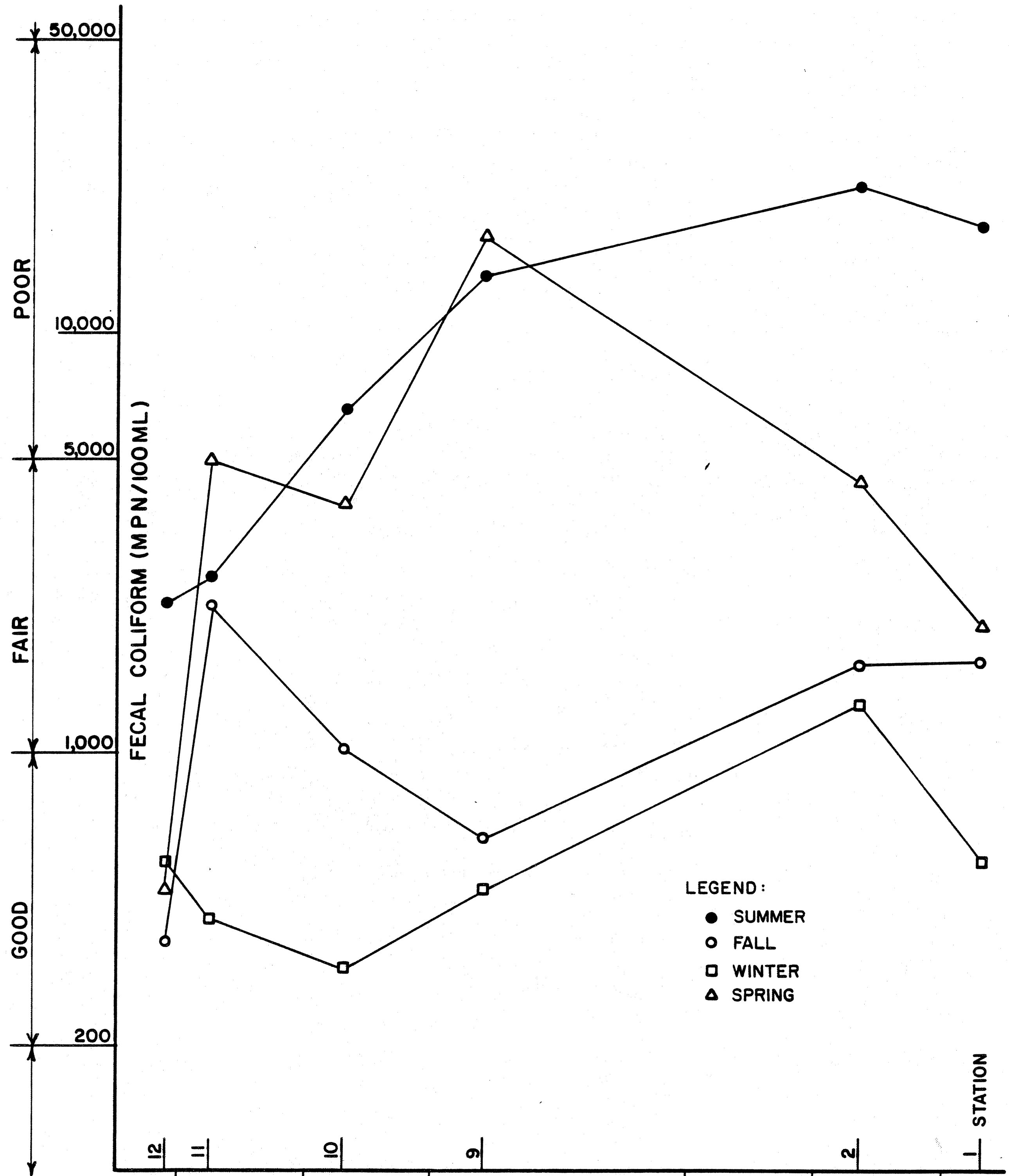


FIGURE 5: WATER QUALITY PROFILE
FECAL COLIFORM



FecaL Coliform

Fecal Coliform levels average in the poor to fair range throughout the watershed. Spring and summer levels are generally in the fair to poor range while fall and winter levels are generally in the good to fair range. Only at Station 17 were the coliform levels consistently in the good range. The high mean Fecal Coliform levels are partially explained by the occurrence of a small number of extremely high readings which bias the average. To obtain a better perspective on the seriousness of the Fecal Coliform averages, a distribution analysis was performed on the data as indicated in Table 14.

An analysis of Table 14 indicates that fecal coliform problems are not as severe or widespread as indicated by mean values. Although periodic problems occur throughout the watershed, such problems are infrequent at most stations. Areas with the highest percentages of samples in the fair to poor range include the lower portion of the main stem (Stations 1, 2) which are subject to a variety of potential coliform sources and in the most highly developed tributaries of Bald Hill Branch (Station 13) and Southwest Branch (Station 15). It is difficult to determine the origin of high fecal coliform levels at any specific station. High coliform levels may result from urban or agricultural runoff, overloaded septic tanks, broken sewer mains or deliberate discharges.

Based on Figure 5, fecal coliform problems are most severe in the middle and lower watershed during the spring and summer seasons. In order to pinpoint specific problems, a more detailed sanitary survey would be required. In particular, measurements should be made of the ratio of fecal coliforms to fecal streptococcus. This ratio would help determine if high fecal coliform levels are of human or animal origin.

While the existing water quality of the Western Branch Watershed is generally good, a decrease in future water quality may occur due to increasing urbanization of the watershed. Although this increased development is not expected to cause an increase in point source discharges, non-point pollution is expected to increase. As agricultural and woodland uses are converted to commercial, industrial and residential uses, runoff generally increases along with the non-point pollutants it contains. The Metropolitian Washington Council of Governments (MWCOG) has quantified the relationships between land use and non-point pollution for a year of average rainfall in the Washington Metropolitan Area. By applying the relationships developed by MWCOG to current and future land uses, the total non-point load of various pollutants can be estimated under existing and future conditions. This comparison is tabulated in Table 15.

Table 14

FREQUENCY DISTRIBUTION (%)
OF FECAL COLIFORM LEVELS

Station	Excellent Range	Good Range	Fair Range	Poor Range
1	13	42	25	21
2	15	35	31	19
7	33	46	8	13
8	32	44	20	8
9	33	42	8	17
10	30	35	30	4
11	36	44	4	16
12	56	24	16	4
13	38	21	38	4
14	50	35	8	8
15	17	50	17	17
16	38	50	8	4
17	41	41	18	0

TABLE 15
NON-POINT POLLUTANT LOADING
(TONS/YEAR)

	Present	Future	% Increase
BOD	431	644	49
Total Phosphorus	14.1	15.6	11
Total Nitrogen	119	144	21
Extractable Lead	4.7	10.0	113
Extractable Zinc	3.6	7.6	111

This analysis shows a considerable increase in non-point pollutant loading due to future development.

9.0 CONSERVATION AREAS

A study of the biological resources and natural habitats of the Western Branch Watershed was undertaken between late summer 1978 and spring 1980 (Reference 14). This study included mapping and classification of significant wetland areas as well as a comprehensive inventory of flora and fauna and an assessment of significant environmental features within the watershed.

9.1 Wetlands

Wetland areas occur throughout the Western Branch Watershed as shown in Figure 6. Wetlands generally occupy the sites of shallow man-made ponds, seepage areas or areas where streams become wide, shallow and slow flowing. These latter conditions frequently are found where roadways or railroad embankments have created artificial blockages, or the stream crosses nearly level, low lying areas of floodplain. These have been mapped at a scale of 1"=400' and described in accordance with the classification scheme presented by Shaw and Fredine (Reference 15).

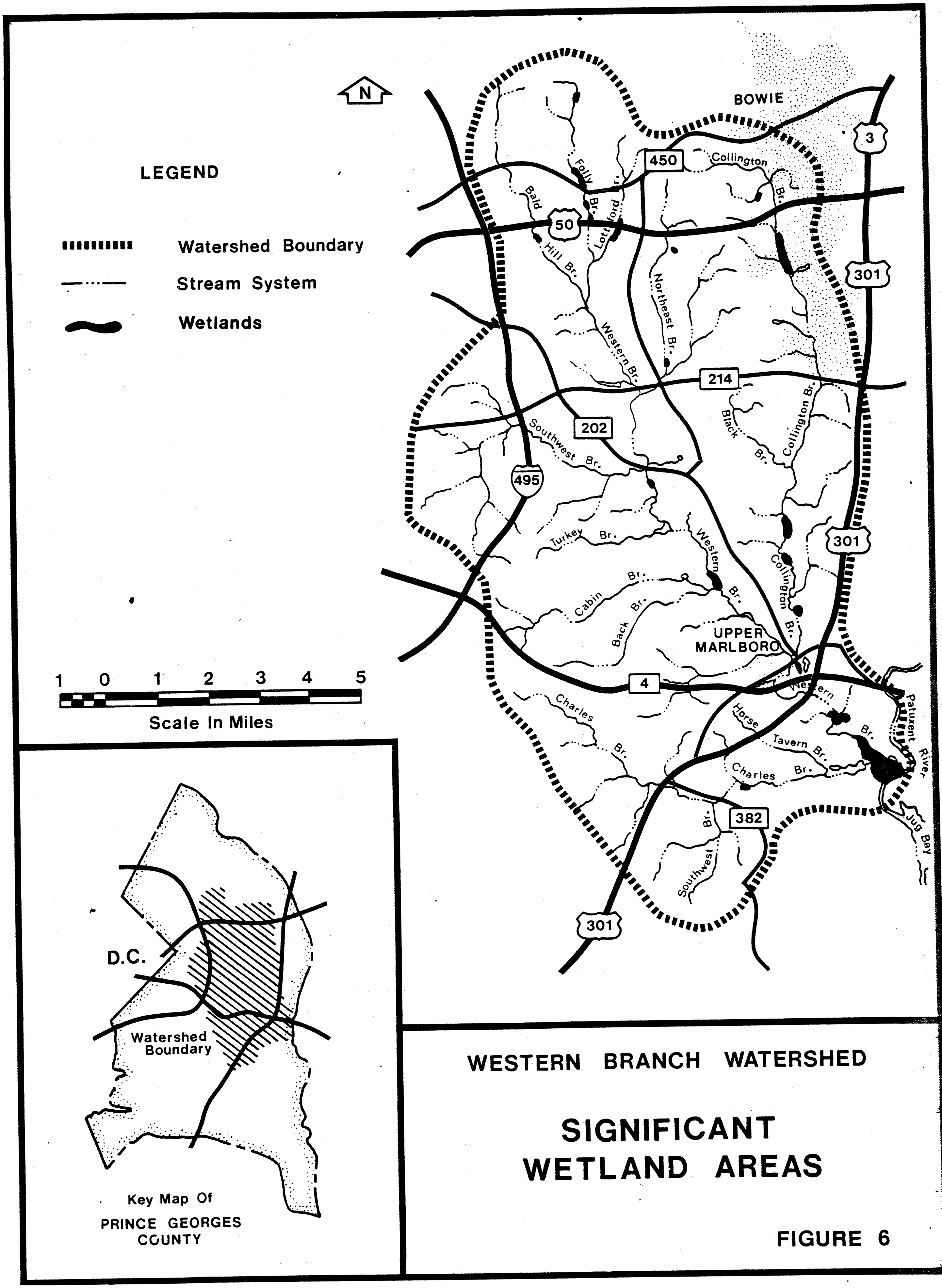
Four basic types of wetlands are found in the watershed:

Type 1 - Seasonally flooded basins or flats.

These wetlands are found in upland depressions or along floodplain where the soil is water-logged or covered by shallow water during highwater periods in spring, late fall or winter. Although these habitats are dry during summer, the soil is saturated long enough for wetland adapted plant species to occur. The fauna of these areas is generally similar to that of deciduous woodlands throughout the watershed. There is, however, a group of interesting amphibians that breed in transient pools and are largely restricted to these habitats. These species include spotted and marbled salamanders, wood frogs and chorus frogs.

Type 3 - Inland Shallow Fresh Marshes

These wetlands occur whenever permanently wet soils are found in open areas. The typical vegetation includes sedges, rushes, cattails, burrweed, and arrowhead. These fresh marshes are inhabited by frogs, aquatic reptiles and numerous fishes.



WESTERN BRANCH WATERSHED

SIGNIFICANT WETLAND AREAS

FIGURE 6

Type 5 - Inland Open Fresh Water

Shallow ponds that are not too turbid for plant growth are included in this type. In many instances, emergent and submerged vegetation is dense and includes water shields, water milfoil, naiads, yellow pond lily, waterlily, pondweeds and waterweed. A wide variety of fishes, amphibians, aquatic reptiles and water fowls frequent these habitats. These ponds also support populations of large mouth bass, catfish and various sunfish which provide opportunity for freshwater fishing.

Type 6 - Shrub Swamp

Shrub swamps have from several inches to a foot or more of water throughout the year and contain alders, black willow, buttonbush, red willow and swamp rose. These habitats support a wide variety of fishes, amphibians, aquatic reptiles, ducks, herons and other marsh birds. The only active beaver lodge found within the watershed occurs in a shrub swamp.

Other inland fresh water wetland types described by Shaw and Fredine (Reference 15) which were not found in the study area include the following:

Type 2 - Fresh Meadows
Type 4 - Deep Fresh Marshes
Type 7 - Wooded Swamps
Type 8 - Bogs

The four types of wetlands in the area are seldom found by themselves. Generally, two or three occur together in complex vegetation patterns responding to varying topographic and hydrologic regimes.

All of the wetland areas are of vital importance to the biological health of the Western Branch watershed and should be preserved. Wetlands provide habitat for a wide variety of plants and animals. Many of these species are specialized aquatic or amphibious forms that do not occur in other habitat types. Wetlands in general, produce enormous quantities of vegetation. Some of this vegetation remains within the wetland, but most dies, decays and is carried downstream where it provides a major source of energy for aquatic food chains in the Patuxent estuary. These vegetation packed wetlands also serve to trap silt and other pollutants before they can be deposited in open waterways. The largest wetland tract present in the watershed, an extensive marsh at the mouth of Western Branch is a tidal wetland and is fully protected by the Maryland Wetland Act of 1970. The other wetlands are afforded some protection by state and local building codes and other regulations. Clear cutting and similar activities however, are generally not prohibited on private, non-tidal wetlands.

9.2 Wildlife

Western Branch watershed contains a well diversified and apparently healthy natural system, including many species of plants and animals that are indicative of a high degree of environmental quality. Some problem areas, however, were discovered. Significant portions of the stream system have undergone noteable sedimentation and show reduced fish species diversity. In addition, no evidence of anadromous fish reproduction was found within the watershed. It is speculated that the riffle beneath the bridge at Water Street in Upper Marlboro may be a barrier to the upstream migration of these species.

The dominant natural terrestrial feature within the watershed is the wooded floodplain associated with Western Branch and its tributaries. Protection of large areas of contiguous woodland is extremely important in promoting wildlife diversity and in the retention of far ranging species.

No endangered animal species were found to reside in the watershed althrough previous records indicate that two protected species, the bobcat (lynx rufus) and the southern bald eagle (Haliaeetus l. leucocephalus) once resided in the watershed. The last known sighting of a bobcat in the watershed was in 1929 so it is unlikely that this species remains. Sightings of southern bald eagles are more recent and it is possible that transient individuals occassionally visit the watershed. Both the bobcat and the southern bald eagle require extensive undisturbed wooded areas, particularly along flood plains or swamps for their survival.

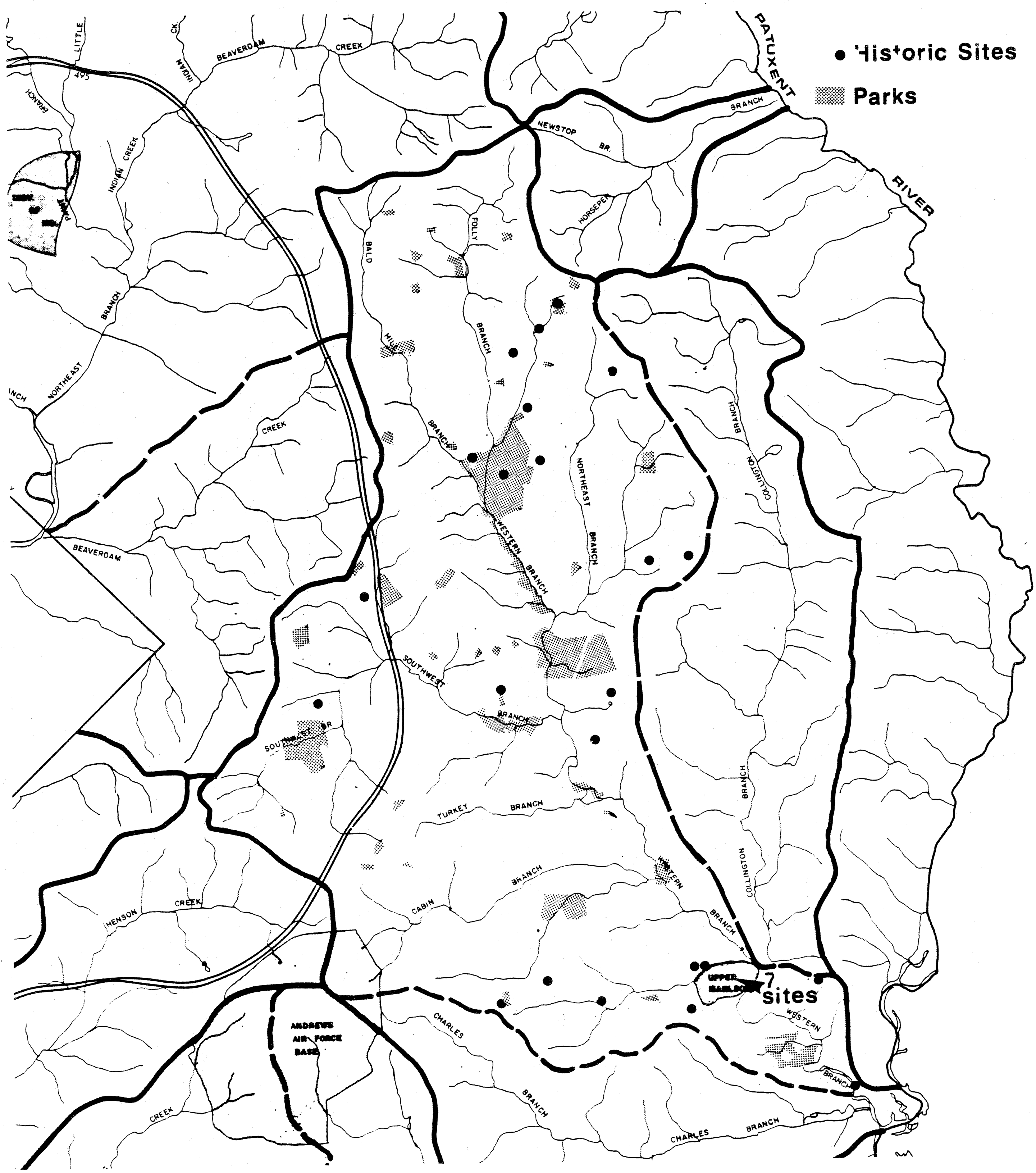
For a complete listing of the Flora and Fauna in the Western Branch Watershed see Appendix B.

9.3 Parklands

Numerous park areas have been acquired in the Western Branch watershed either through outright purchase or dedication at the time of subdivison (see Figure 7). Of the six major classes of Park Recreation Areas, five are represented in the Western Branch study area. These include Neighborhood Park Recreation Areas, Community Park Recreation Areas, Countywide Park Recreation Areas and Special Park Recreation Areas. Only Urban Park Recreation Areas are not found in the study area. The most common types of park facilities found include Neighborhood Parks, Neighborhood Playgrounds and Community Parks. Major park facilities with greater than local usage include Watkins Regional Park, Enterprise Golf Course and the Capital Center Sport Arena which is owned by M-NCPPC and leased to the operator. In all, a total of 2,355 acres of the study area is currently owned by the M-NCPPC. Of this total, 466 acres are classified as Stream

Figure 7

PARKS AND HISTORIC SITES WESTERN BRANCH WATERSHED



Valley or River Park. Many additional acres included in other park and recreation area classes are also adjacent to Western Branch and its tributaries.

9.4 Historic Sites

32 sites within the Western Branch watershed are classified as Historic Sites on the Approved Historic Sites and Districts Plan. These sites shown in figure 10 have unique physical features or architectural and cultural importance to the County. These sites and their locations are:

Buena Vista (70-17) - A two and one-half story frame structure with two interior chimneys at the south end constructed around 1845. It is located at the southeast corner of the intersection of Glenn Dale and Annapolis Roads.

Marietta Manor (70-20) - A two and one-half story, federal style brick structure built between 1810 and 1816. It is located on Bell Station Road between Annapolis Road and George Palmer Highway.

Magruder-Brannon House (70-30) - A T-shaped frame crossed-gable house fronting on the east, with german siding on the first story and modern wooden wall shingling on the second. It is located on Annapolis Road, south of Bell Station Road.

Fairview (71A-13) - A stuccoed brick house, two stories high, five bays wide built around 1800. Its location is 4410 Church Road, Mitchellville.

Berry-Beane House (72A-4) - A one- and one-half story frame structure with gable roof, significant for its unusual architecture and expansion. Its location is 900 Brightseat Road, Landover, and was constructed around the early part of 1800.

Belvidere (73-5) - A hip-roof structure of the 1801-1825 architectural style, on Belvedere Road, Mitchellville.

White Farm (73-6) - A 1939 brick mansion on the west side of Enterprise Road between Lottsford Road and U.S. Route 50. Mid-1800's tobacco barn.

The Cottage at Warington (73-7) - A one- and one-half story frame house, three bays wide with the entrance in the third bay of the south facade. It was constructed in 1842 and is located on Lottsford Vista Road, Mitchellville.

Mount Lubentia (73-16) - A brick house laid in flemish bond, two- and one-half stories high and five bays wide, located at 603 Largo Road, Upper Marlboro.

Chelsea (73-18) - A large frame, two-story, five bay house with hip-roof and balustered deck. Its location is 601 Watkins Park Drive, Upper Marlboro.

Pleasant Prospect (74A-6) - A two- and one-half story, five bay brick structure built in 1798 for Dr. Isaac Ducket. It is located north of Woodmore Road between Enterprise Road and Church Road.

Partnership (74A-15) - A farm with a small cemetary on property located on Central Avenue in Largo between Enterprise and Church Roads.

Concord (75A-1) - A two- and one-half five bay brick structure with a gable roof built in 1798 for Zachariah Berry. It is located between Walker Mill Road and Walker Mill Drive.

Woodlawn (78-1) - A large frame, five-bay, two- and one-half story Greek Revival style house built in 1858. Its location is 1133 Largo Road, Upper Marlboro.

Melwood Park (78-15) - A 7-bay, two- and one-half story structure with external end chimneys and an unusual gable roof built around 1729. This structure is located on the north side of Route 408 in Upper Marlboro.

Charles Hill (78-17) - a two-story frame building with a five bay main facade at 11700 Marlboro Pike, Upper Marlboro.

The Cottage (78-18) - A large two-story frame gable roofed house built in three sections, the central section being probably the oldest. Its location is 11904 Marlboro Pike, Upper Marlboro.

Ashland (79-11) - A two-story, hip-roofed frame house with a three bay east facade built in 1867. It is located on Marlboro Pike, east of Upper Marlboro.

Kingston (79-13) - A one- and one-half story frame house resting on a brick basement; the roof extends on both east and west facades to create porches across the entire length and there are three dormers on each slope. It was built in 1730. Its address is 5415 Old Crain Highway, Upper Marlboro.

Many additional acres included in other park and
are also adjacent to Western Branch and its tribu-

n the Western Branch watershed are classified as
proved Historic Sites and Districts Plan. These
have unique physical features or architectural and
e County. These sites and their locations are:

- A two and one-half story frame structure with
s at the south end constructed around 1845. It is
east corner of the intersection of Glenn Dale and

) - A two and one-half story, federal style brick
en 1810 and 1816. It is located on Bell Station
s Road and George Palmer Highway.

e (70-30) - A T-shaped frame crossed-gable house
with german siding on the first story and modern
on the second. It is located on Annapolis Road,
Road.

stuccoed brick house, two stories high, five
1800. Its location is 4410 Church Road,

4) - A one- and one-half story frame structure
icant for its unusual architecture and
n is 900 Brightseat Road, Landover, and was
early part of 1800.

-roof structure of the 1801-1825 architectural
d, Mitchellville.

39 brick mansion on the west side of Enter-
ford Road and U.S. Route 50. Mid-1800's

(73-7) - A one- and one-half story frame
ith the entrance in the third bay of the south
ced in 1842 and is located on Lottsford Vista

uilding, one-story
to replace an 18th
urch Street, Upper

n two sections: the
and the northern is
ts location is 14518

n the early 1870's.
roofed strucure with
ndow at loft level in
at Governor Oden

-roofed frame house,
ng the central entrance
m Street, in Upper

bed brick house five
9th century. It is
pper Marlboro.

story frame building
ated on Old Crain Highway

roofed frame house built
s wide with the entrance
s 12601 Marlboro Pike, in

ory brick house with a
roof. It stands in a
of the Patuxent River.
homas Hollyday, who became
nty Court. Its location
).

within the study area

he Planning Area in which
dition, there are a number
area (Reference 16).

9.5 Archeological Site

Field surveys conducted within the Western Branch Study Area in conjunction with Highway and Sewerage construction have identified several sites containing Indian artifacts. These sites are located primarily in the lower portion of the basin below Upper Marlboro.

According to Dr. Tyler Bastian, Maryland State Archeologist, the potential for finding additional sites containing Indian or colonial artifacts within the study area is good to excellent. For this reason, Dr. Bastian recommended that a field investigation by a qualified archeologist - be conducted in conjunction with any structural measures implemented as a result of the watershed study.

10.0 APPLICATION OF STUDY

This study identifies those areas of hydrogeomorphic fragility where intensive development might wreak unrecompensible damage to the immediate environment and surroundings. Such identification will be utilized for land use planning and zoning with strong recommendations for reducing the zoning intensity in such areas and steering intensive development to areas environmentally better suited for it. Such preemptive planning can significantly reduce the number and cost of storm drainage systems in the County.

The discharge values and corresponding water surface elevations at several locations along streams studied have been determined. The time and cost presently incurred by agencies and developers in developing flood limits and design information will be substantially reduced as most of the necessary data will become available.

Those road crossings that are subject to inundation during high flows are also identified. This information will be made available to the office of Emergency Preparedness for dissemination to the public during "storm watches".

As the county continues its rural to suburban transformation, the stream system suffers from increased non-point pollutant loadings. Idenfification of the pollutant loadings is very necessary to respond to the U.S. Environmental Protection Agency's call for non-point pollution abatement.

The information presented in this report will be used to develop an optimal management plan for the watershed.

11.0 PREVIOUS STUDIES

In 1972, the U.S. Army Corps of Engineers prepared a Flood Plain Information (FPI) report on Western Branch and the following tributaries: Folly, Lottsford and Bald Hill Branches. Discharge values for the 100 year flood event developed by the Corps of Engineers in the 1972 study were compared with values determined in this report, for existing land use development. Differences in flow values exist at different locations along the main steam. The differences were discussed with the Corps of Engineers (Baltimore District) at a meeting in August 1980. The Corps of Engineers agrees in a letter dated September 25, 1980 that this study which uses more up-to-date data and land use patterns and shows that the flood flows in the 1972 report corresponding to specified flood frequencies are low, revises the flow values in the FPI.

REFERENCES

1. Storm Water Management Task Force, Storm Water Management Report, Prince George's County, Maryland, April 1977.

2. U.S. Army Corps of Engineers, Flood Plain Information, Western Branch, Prince George's County, Maryland, December 1972.

3. Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, USDA, 1971.

4. Soil Conservation Service, Computer Program for Project Formulation, Hydrology, Technical Release No. 20, USDA, May 1965.

5. Soil Conservation Service, College Park, Maryland, Personal Communication.

6. Soil Conservation Service, Hydrologist, Broomall, Pennsylvania, Personal Communication.

7. U.S. Water Resources Council, Guidelines for Determining Flood Flow Frequency, Bulletin No. 17, March 1976.

8. Chow, V. T., Handbook of Applied Hydrology, 1964.

9. Udhiri, S. Review and Analysis of Storm Water Discharge Rates, Anacostia River Watershed, Technical Report Publication No. 0764791560, The Maryland-National Capital Park and Planning Commission, Upper Marlboro, Maryland, Sept. 1978.

10. Anderson, D. G., Effects of Urban Development on Floods in Northern Virginia, U.S. Geological Survey, Water-Supply Paper 2001-C, 1970.

11. U.S. Army Corps of Engineers, HEC-2 Water Surface Profiles, Generalized Computer Program, Users Manual, Hydrologic Engineering Center, Davis, California, August, 1979.

12. U.S. Army Corps of Engineers, Review Report on Flood Control and Allied Purposes, Patuxent River and Tributaries, Maryland, February, 1975.

13. Metropolitan Washington Council of Government, Metropolitan Washington Water Quality Management Plan, March, 1978.

14. Norden, A. W. and Beth B., Biological Resources and Environmental Assessment Inventory, Western Branch Watershed, Prince George's County, Maryland, 1979.

15. Shaw, S. P. and Fredine, C. G., Wetlands of the United States, Circular 39, Fish and Wildlife Service, U.S. Department of the Interior, 1956.

16. Maryland-National Capital Park and Planning Commission, Approved Historic Sites and Districts Plan Prince George's County, Maryland, 1981

12.0 BIBLIOGRAPHY

Richmond, S.B., Statistical Analysis, 1964.

Rao, N. S., Hydraulics, 1962.

APPENDIX "A"

ROUTED DISCHARGE VALUES AT SPECIFIC LOCATIONS

APPENDIX A

ROUTED DISCHARGE VALUES AT SPECIFIC LOCATIONS

WATERCOURSE & LOCATION	Drainage Area	Present Land Use 2	10	100	500	Future Land Use 2	10	100	500
WESTERN BRANCH									
- Above the Patuxent (mouth)	92.12	3080	8815	16835	24425	4235	10850	19775	27545
- Above Collington Br.	65.64	2595	7210	13565	19275	3545	8740	15585	21490
- Above Fed. Springs. Br.	61.67	2600	7150	13415	19100	3520	8640	15420	21265
- Above Southwest Br.	29.64	1220	3800	7435	10675	1500	4215	7825	10930
- Above Northeast Br.	18.33	660	1980	3760	5250	985	2635	4620	6205
BALD HILL BRANCH									
- At the Mouth	5.70	370	1040	1735	2200	530	1240	1890	2545
- At Conrail	1.59	380	920	1515	1870	640	1370	1950	2285
- At Good Luck Road	1.16	310	750	1245	1600	545	1150	1695	2015
- At Brae Brooke Dr.	.6	105	205	315	395	140	260	385	480
LOTTSFORD BRANCH									
- At the mouth	9.34	260	855	1790	2735	445	1250	2510	3605
- Above Folly Branch	2.69	205	590	1110	1550	330	835	1435	1880
- At Route 50	1.82	165	510	965	1375	295	745	1315	1690
- At Route 450	1.03	120	380	710	985	190	510	915	1230

APPENDIX A

ROUTED DISCHARGE VALUES AT SPECIFIC LOCATIONS

WATERCOURSE & LOCATION	Drainage Area	Present Land Use 2	Present Land Use 10	Present Land Use 100	Present Land Use 500	Future Land Use 2	Future Land Use 10	Future Land Use 100	Future Land Use 500
FOLLY BRANCH									
- At the mouth	6.24	205	660	1340	1945	350	1005	1860	2515
- Upstream of Conrail	2.11	235	680	1300	1820	725	1585	2605	3375
- At Route 193 (Glenn Dale Road)	1.59	150	440	865	1220	410	950	1630	2135
- At Route 564 (Lanham-Severn Road) (most upstream crossing)	.44	35	130	290	425	80	275	525	715
CABIN BRANCH									
- At the mouth	8.44	820	2725	4890	6570	1830	4110	6790	8950
- Above Back Branch	5.67	605	1930	3430	4590	1400	3000	4940	6490
BACK BRANCH									
- At the mouth	2.77	215	845	1590	2060	435	1175	1865	2475
- At Roblee Drive	1.00	65	360	770	1100	320	800	1415	1870
- At Melwood Road	.40	30	145	350	510	235	555	920	1205

APPENDIX A

ROUTED DISCHARGE VALUES AT SPECIFIC LOCATIONS

		Present Land Use				Future Land Use			
WATERCOURSE & LOCATION	Drainage Area	2	10	100	500	2	10	100	500
FOLLY BRANCH									
- At the mouth	6.24	205	660	1340	1945	350	1005	1860	2515
- Upstream of Conrail	2.11	235	680	1300	1820	725	1585	2605	3375
- At Route 193 (Glenn Dale Road)	1.59	150	440	865	1220	410	950	1630	2135
- At Route 564 (Lanham-Severn Road) (most upstream crossing)	.44	35	130	290	425	80	275	525	715
CABIN BRANCH									
- At the mouth	8.44	820	2725	4890	6570	1830	4110	6790	8950
- Above Back Branch	5.67	605	1930	3430	4590	1400	3000	4940	6490
BACK BRANCH									
- At the mouth	2.77	215	845	1590	2060	435	1175	1865	2475
- At Roblee Drive	1.00	65	360	770	1100	320	800	1415	1870
- At Melwood Road	.40	30	145	350	510	235	555	920	1205

APPENDIX A

ROUTED DISCHARGE VALUES AT SPECIFIC LOCATIONS

WATERCOURSE & LOCATION	Drainage Area	Present Land Use 2	10	100	500	Future Land Use 2	10	100	500
NORTHEAST BRANCH									
- At the mouth	8.81	795	2250	4335	6180	830	2115	4005	5665
- Upstream to - Tributary B	3.84	330	980	1905	2725	305	765	1355	1840
- At Woodmore Road	2.86	250	850	1690	2400	95	260	465	670
- At Route 50	1.39	210	670	1265	1755	380	1050	1870	2500
TRIBUTARY B (N.E. Branch)									
- At the mouth	4.05	380	1120	2155	3050	520	1490	2760	3885
- At Woodmore Road	1.33	210	600	1060	1415	330	865	1415	1905
SOUTHWEST BRANCH									
- At the mouth	15.40	1730	4235	6930	9715	2415	5265	8770	12000
- At the Beltway	8.28	1240	3060	4780	6855	1570	3390	5720	8340
- At Ritchie Road	5.75	1175	2735	4690	6235	1515	3465	5790	7740
- Above Ritchie Branch	2.83	885	2130	3620	4805	1070	2485	4160	5480
- At Kipling Parkway	.63	295	710	1185	1590	340	815	1385	1830

APPENDIX A

ROUTED DISCHARGE VALUES AT SPECIFIC LOCATIONS

WATERCOURSE & LOCATION	Drainage Area	Present Land Use 2	10	100	500	Future Land Use 2	10	100	500
FOLLY BRANCH									
- At the mouth	6.24	205	660	1340	1945	350	1005	1860	2515
- Upstream of Conrail	2.11	235	680	1300	1820	725	1585	2605	3375
- At Route 193 (Glenn Dale Road)	1.59	150	440	865	1220	410	950	1630	2135
- At Route 564 (Lanham-Severn Road) (most upstream crossing)	.44	35	130	290	425	80	275	525	715
CABIN BRANCH									
- At the mouth	8.44	820	2725	4890	6570	1830	4110	6790	8950
- Above Back Branch	5.67	605	1930	3430	4590	1400	3000	4940	6490
BACK BRANCH									
- At the mouth	2.77	215	845	1590	2060	435	1175	1865	2475
- At Roblee Drive	1.00	65	360	770	1100	320	800	1415	1870
- At Melwood Road	.40	30	145	350	510	235	555	920	1205

APPENDIX A

ROUTED DISCHARGE VALUES AT SPECIFIC LOCATIONS

WATERCOURSE & LOCATION	Drainage Area	Present Land Use 2	10	100	500	Future Land Use 2	10	100	500
WESTERN BRANCH									
- Above the Patuxent (mouth)	92.12	3080	8815	16835	24425	4235	10850	19775	27545
- Above Collington Br.	65.64	2595	7210	13565	19275	3545	8740	15585	21490
- Above Fed. Springs. Br.	61.67	2600	7150	13415	19100	3520	8640	15420	21265
- Above Southwest Br.	29.64	1220	3800	7435	10675	1500	4215	7825	10930
- Above Northeast Br.	18.33	660	1980	3760	5250	985	2635	4620	6205
BALD HILL BRANCH									
- At the Mouth	5.70	370	1040	1735	2200	530	1240	1890	2545
- At Conrail	1.59	380	920	1515	1870	640	1370	1950	2285
- At Good Luck Road	1.16	310	750	1245	1600	545	1150	1695	2015
- At Brae Brooke Dr.	.6	105	205	315	395	140	260	385	480
LOTTSFORD BRANCH									
- At the mouth	9.34	260	855	1790	2735	445	1250	2510	3605
- Above Folly Branch	2.69	205	590	1110	1550	330	835	1435	1880
- At Route 50	1.82	165	510	965	1375	295	745	1315	1690
- At Route 450	1.03	120	380	710	985	190	510	915	1230

APPENDIX A

ROUTED DISCHARGE VALUES AT SPECIFIC LOCATIONS

WATERCOURSE & LOCATION	Drainage Area	Present Land Use 2	10	100	500	Future Land Use 2	10	100	500
RITCHIE BRANCH									
- At the mouth	2.29	325	705	1245	1735	485	1120	1860	2570
- At D'Arcy Road	1.22	210	420	735	1065	315	670	1320	1880
TRIBUTARY D (to S.W. Br.)									
- At the mouth	.52	115	320	560	755	310	685	1100	1420
TRIBUTARY E (to S.W. Br.)									
- At the mouth	1.12	160	530	970	1265	390	955	1400	1725
TRIBUTARY A (to S.W. Br.)									
- At the mouth	1.23	165	510	860	1145	320	710	1165	1570
TURKEY BRANCH									
- At the mouth	1.98	165	555	1065	1505	315	890	1630	2335
- At Ritchie Marlboro Rd.	1.27	65	290	625	960	210	650	1275	1835
FEDERAL SPRINGS BRANCH									
- At the mouth	3.92	295	990	1780	2245	590	1540	2225	2715
- Above Tributary A (to Federal Springs Br.)	2.12	110	480	1080	1620	365	1230	2180	2875
TRIBUTARY A									
- At the mouth	.69	145	420	770	1050	190	600	1100	1505

APPENDIX "B"

WESTERN BRANCH WATERSHED
BIOLOGICAL FEATURES INVENTORY

WESTERN BRANCH WATERSHED
BIOLOGICAL FEATURES INVENTORY

Prepared by

Arnold W. Norden
Beth B. Norden

Table of Contents

Tables

Figures

Recommendations

1. The dominant natural terrestrial feature within the study area is the wooded floodplain associated with Western Branch and its tributaries. Construction activities involving this area are generally controlled by local building codes, state and federal regulations. However, floodplains are still susceptible to large scale clear cutting for timber or agricultural production. It appears that these activities will become more prevalent in the future and could pose a serious threat to these important woodlands. It is recommended that action be taken to bring the clear cutting of woodlands within the 100 year floodplain under agency control. This action would preserve large areas of undisturbed wildlife habitat, minimize the transport of sediment and other pollutants carried by stormwater runoff into receiving waters, maintain the beneficial hydrologic features of forested floodplains, and retain an extensive ribbon of green space running throughout the watershed.

2. Sedimentation is a serious problem within the Western Branch Watershed. Existing legislation directed toward sediment control should be stringently applied. A survey of the watershed should also be conducted to identify poorly managed agricultural enterprises or other sites generating excessive amounts of silt. Once identified, remedial action should be taken.

3. Permit applications for the construction of shopping malls, parking areas, residential developments, major roadways or other sources of polluted stormwater runoff should be carefully reviewed to determine their effect on water quality. Features preventing the introduction of runoff from impervious surfaces directly into receiving waters should be incorporated into stormwater management plans. Directing runoff over grassy areas, through wetlands or vegetated swales would significantly increase its quality and reduce the stress applied to aquatic communities inhabiting adjacent portions of the natural drainage system.

4. A series of biological monitoring stations should be established within the watershed. Yearly evaluation of populations of selected sensitive species would provide a data base that could reveal deterioration of air quality or the aquatic environment. It is recommended that this network be established as follows:

<u>Air Quality</u>- Five stations (2, 5, 6, 8, 10) should be established as air quality monitoring sites. These stations

SUMMARY

This report presents an inventory and description of the vegetative and wildlife communities within the Western Branch Watershed in Prince Georges County Maryland and recommends actions needed to protect and improve their biological integrity and diversity. The study was initiated in conjunction with a comprehensive watershed management plan and will be used to help analyze the positive and negative impacts of potential structural and non-structural storm water management and flood control measures. This study was financed in part through a grant administered by the Maryland Coastal Zone Management Program. The inventory demonstrates that the flora and fauna communities of the Western Branch watershed are diversified and healthy, although sedimentation has reduced fish species in some areas, Lichen species diversity is reduced in the northwest portion of the drainage and anadromous fish apparently no longer reproduce here. The existing biotic diversity and environmental quality can be retained by managing growth to preserve the wooded floodplain and wetlands adjacent to Western Branch and its tributaries, reducing sedimentation and maintaining good water quality throughout the drainage.

are identified in the discussion of lichens given in the following text. Since lichens are useful indicators of atmospheric pollution, yearly examination of these sites would indicate if air quality within the Western Branch Watershed is deteriorating or improving. A wide variety of procedures for the use of lichens as pollution indicators are available. However, the simplest is photographing permanently delineated quadrats on a regular basis and comparing the photographs for signs of healthy growth or deterioration of individual plants. This technique has been described in detail by Windler (1977), and it is recommended for use in this study.

Aquatic Environment- Five stations (4, 6, 8, 11, 12) should be established as aquatic environment monitoring sites. These stations are identified in the discussion of fishes given in the following text. It is recommended that a set length of stream at each of these sites be examined on a yearly basis to assess the depth and extent of silt cover, and the diversity of the fish community present. Increasing silt cover and/or simplification of the fish community would indicate local deterioration of the aquatic system. Fish collections should be made from year to year with identical seins and should cover the same stream area an identical number of times. Collections should be made in mid or late summer during periods of normal water depth and velocity.

5. A survey should be initiated to determine if anadromous fishes are prevented from migrating up Western Branch by the riffle at Water Street or unsuitable aquatic conditions in the portion of Western Branch running through Upper Marlboro. This survey should include two phases, a spring spawning survey and a summer nursery survey. The spring spawning survey would be directed toward the detection of migrating adult individuals in spawning condition and should involve the placement of a series of traps above and below the Water Street riffle. The summer nursery survey would be directed toward detection of eggs or larvae in plankton samples collected above and below the Water Street riffle. These surveys should be coordinated with the larger Anadromous Fish Survey Project currently being conducted by the Tidewater Fisheries Administration, Maryland Department of Natural Resources. For maximum comparability, the design and use of traps and plankton nets should be identical to those used by DNR (see O'dell, Gabor and Mowrer 1977, for details).

Introduction

Prince Georges County occupies a unique position within the State of Maryland. The north and northwestern portions of the county include the heavily urbanized suburbs of Washington, D.C., while the central and southern portions of the county are relatively undeveloped with extensive areas of undisturbed forest and wetland. As intensive development expands outward from the Baltimore-Washington Metropolitan area, Prince Georges County, with its desirable rural quality and ease of access to these large urban centers, will undergo considerable growth.

Much of this growth can be expected to occur within the portion of the county drained by Western Branch. The existing development in this drainage basin has been relatively unobtrusive and the Western Branch Watershed today exhibits a natural and man-made environment that is in reasonable balance. Intelligent growth management will be required to maintain this balance and preserve existing environmental qualities of this region. This assessment was undertaken to provide the baseline environmental information necessary to guide this management process.

Aquatic System

Western Branch, a tributary of the Patuxent River, drains approximately 110 square miles of east-central Prince Georges County (Figure 1). The drainage network shows a well developed dendritic pattern with three main branches; Western Branch, Collington Branch, and Charles Branch. The upper reaches of Western Branch (Bald Hill, Folly, and Lottsford Branches) flow through heavily urbanized areas. Portions of these headwater streams have been straightened and now run through concrete lined channels. Below these headwater streams, Western Branch generally drains rural, low density residential or wooded regions, except where the mainstream flows through Upper Marlboro and the Kettering Estates development. For the upper half of its length, Collington Branch flows through or directly adjacent to the City of Bowie. Below Bowie, the stream flows through sparsely developed areas or woodland. Collington Branch and Western Branch converge at Upper Marlboro. Charles Branch generally flows through sparsely developed agricultural or woodland and enters Western Branch near its mouth.

Extensive floodplains are developed along much of this drainage network. These floodplains are generally undeveloped and, in many areas, are covered by mature deciduous woodland. Floodplain mapping has been completed for most of the watershed.

The stream system is typically low gradient and flows over a substrate of gravel, pebbles, sand or silt. The water is generally of good quality although its silt load is considerable due to adjacent residential or commercial development and agricultural activity. Rocky riffles are absent except where placed artificially, and pools are separated by shallow runs. In some locations, emergent or submerged vegetation is present. The only other instream cover available to aquatic wildlife is undercut banks or fallen logs and sticks with accumulations of deciduous leaves and other debris. For approximately the last 1.6 miles of its length, Western Branch becomes a wide tidal stream with extensive areas of marshland along its banks.

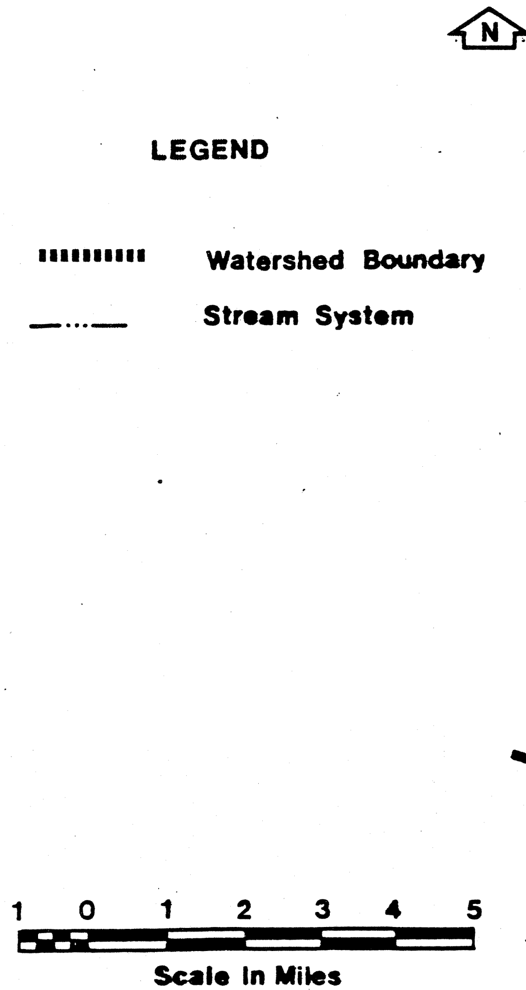
In addition to the stream system draining this watershed, a large number of ponds are also present. These ponds appear to be artificial and result from deliberate pond construction or unintentional blockage of streams at roadway or railway crossings. The location of significant ponds is shown on Figure 2.

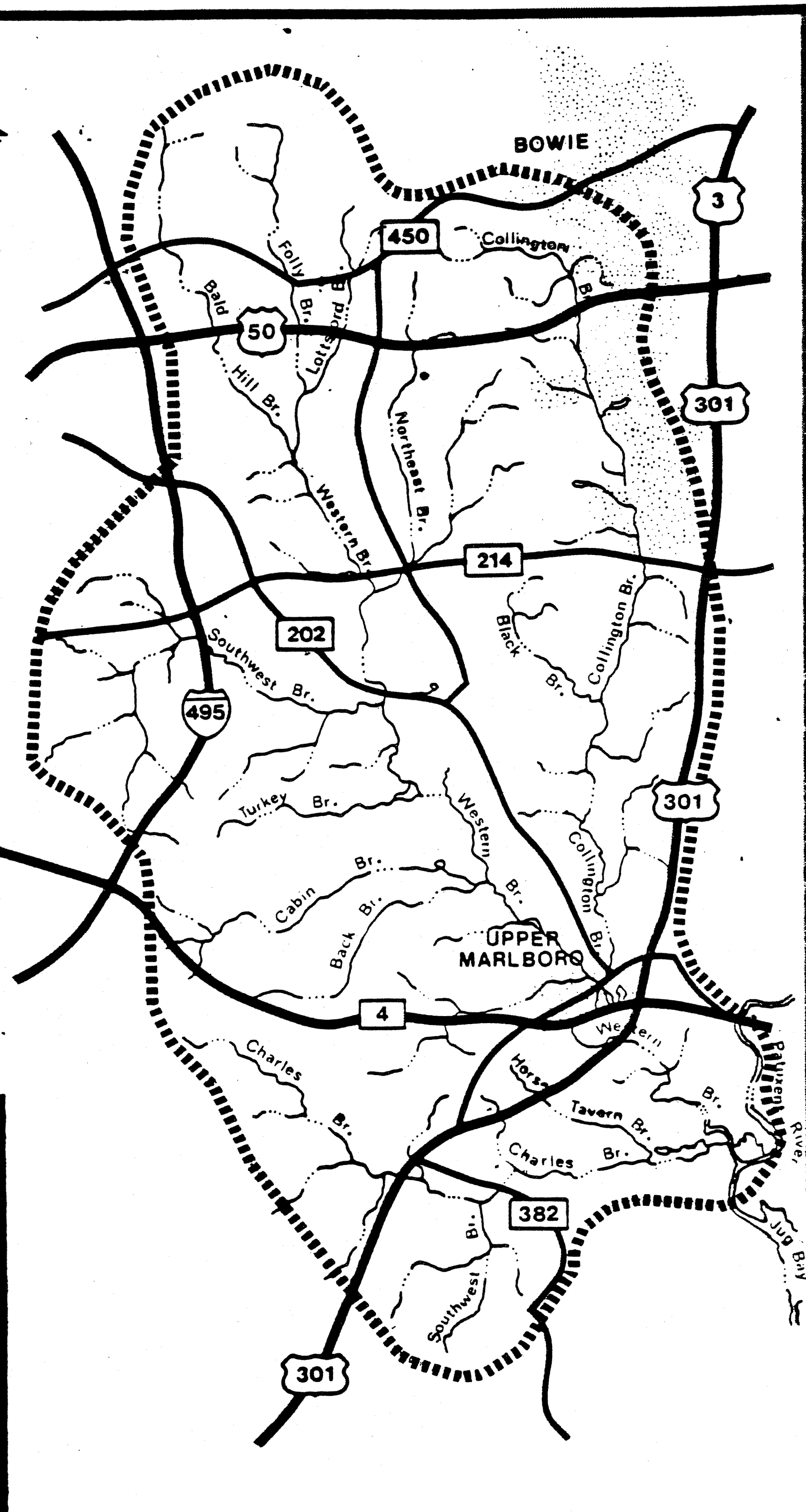
Terrestrial System

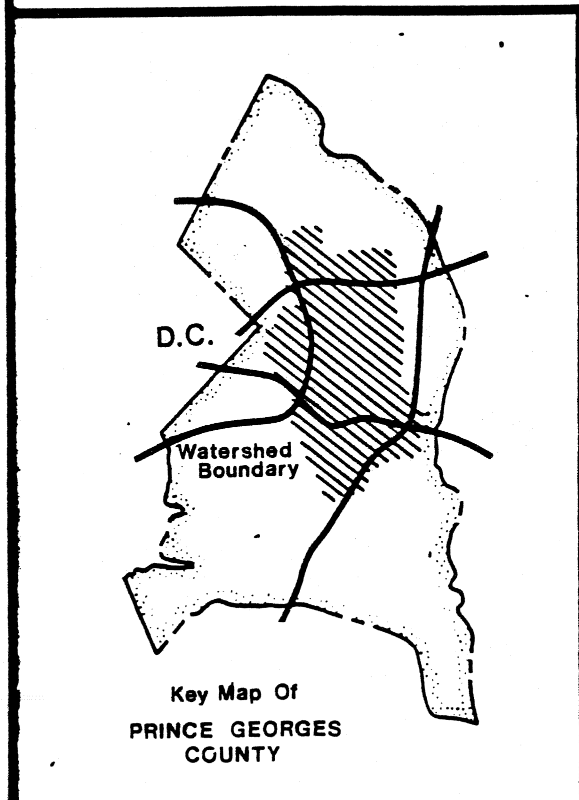
The Western Branch Watershed exhibits a wide variety of land use types ranging from mature deciduous woodland to urbanized areas with commercial and light industrial development. Most of the watershed, however, is undeveloped or developed for agricultural or low density residential use. Relative percentages of major land use types within the Western Branch Watershed are given below.

Land Use Type	Acres	Percent
Residential	9914.4	14.05
Commercial-Light Industrial	550.8	0.78
Other Development	3672.0	5.20
Crop and Pastureland	25704.0	36.41
Undeveloped		
Upland Deciduous Forest	19186.2	27.18
Lowland Deciduous Forest	555.8	0.78
Upland Mixed Forest	10189.8	14.43
Upland Brushland	367.2	0.52
Non-Forested Wetland	367.2	0.52
Forested Wetland	91.8	0.13
Total	70594.2	100.00

This land use information was provided by the Maryland Department of State Planning and is drawn from the Maryland







WESTERN BRANCH WATERSHED

AQUATIC SYSTEM

FIGURE 1

Automated Geographic Information System (MAGI). As defined by the MAGI System, the Western Branch Watershed is slightly larger that the 110 square miles estimated in the present study. However, the relative relationship of these land use types is still applicable. Most of the watershed (36.41%) is presently being utilized for agricultural production or is undeveloped (43.56%). Only 20.03% has been developed.

The undeveloped portions of the watershed can be divided into the following major habitat types. These descriptions are necessarily brief and the interested reader is referred to Hotchkiss and Stewart (1979) for additional information on the overall ecology of similar habitat types elsewhere in Prince Georges County. Detailed lists of plants and animals inhabiting these areas are presented in later portions of this document. The distribution of each of these habitats within the Western Branch Watershed has been delineated on aerial photographs at a scale of one inch equals 400 feet. These habitat maps are available for inspection at the Environmental Planning Division, The Maryland-National Capital Park and Planning Commission, 14741 Governor Oden Bowie Drive, Upper Marlboro, Maryland.

Grassland-

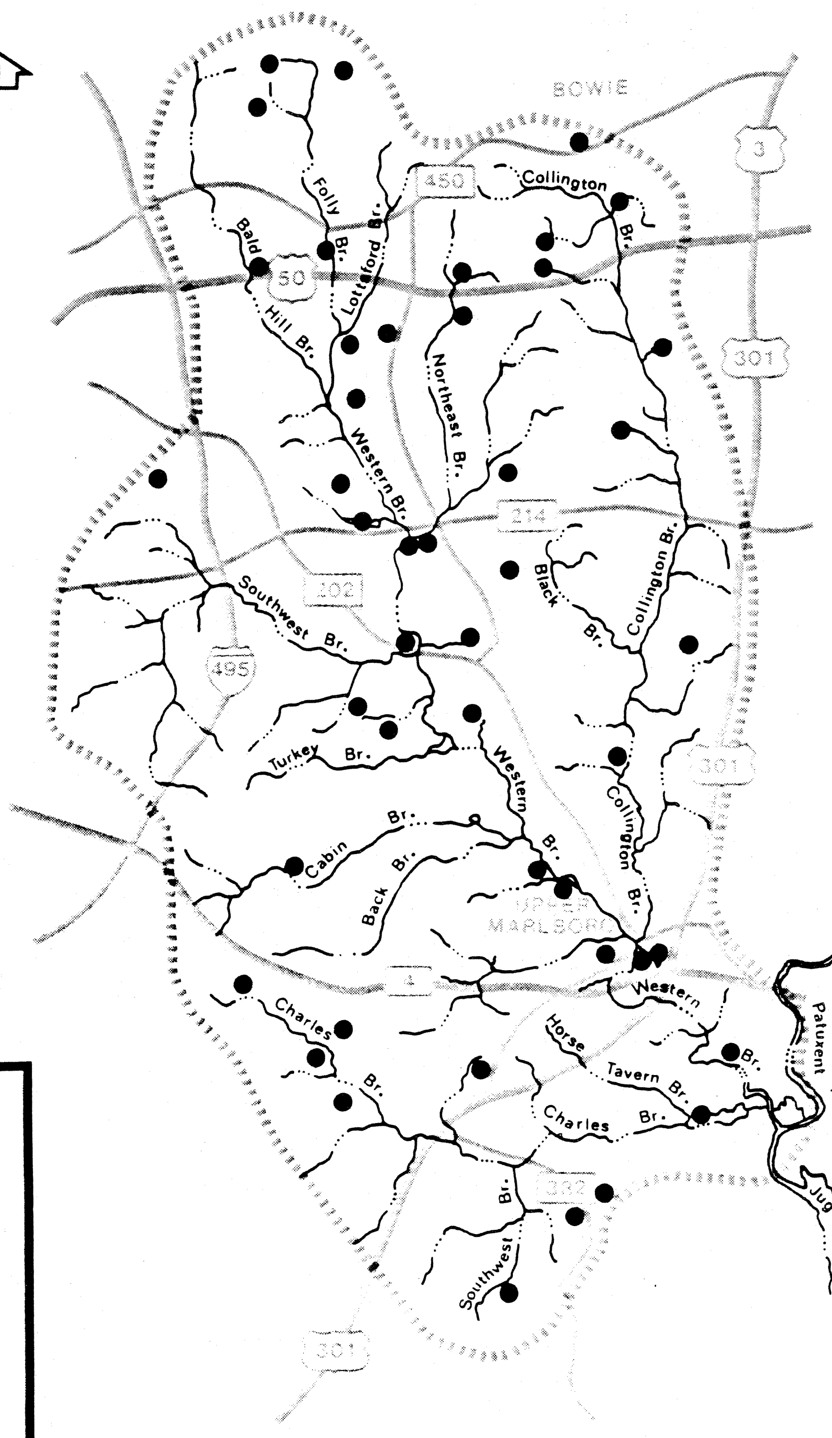
As defined here, grassland includes those portions of the watershed that are permanently maintained as areas of short grass, including lawns, pastures, golf course fairways and turf farms. The typical vegetation includes *Poa* sp., *Plantago* sp., and *Taraxacum officinale*. These areas are frequently utilized by cottontail rabbits, moles, and various ground foraging passerine birds. However, grassland areas are not of primary importance to the biotic diversity of the study area. Since they are deliberately cultivated for their commercial or aesthetic value, grassland should not decrease in extent as the watershed developes.

Old Field-

Old field habitat includes previously cultivated land that is now fallow, regularly disturbed areas along roadsides and the edges of woodlands, and abandoned fields that have not yet reached the successional stage characterized by the presence of immature deciduous trees. These areas typically include an abundance of weedy plant species such as *Solidago*, *Rubus*, numerous grasses and composits. Because of the large volume of seeds produced and dense ground cover provided, old fields are inhabited by many small seed eating or insectivorous mammals and birds. Trash or litter piles within or adjacent to these areas are excellent places to look for snakes, lizards and small

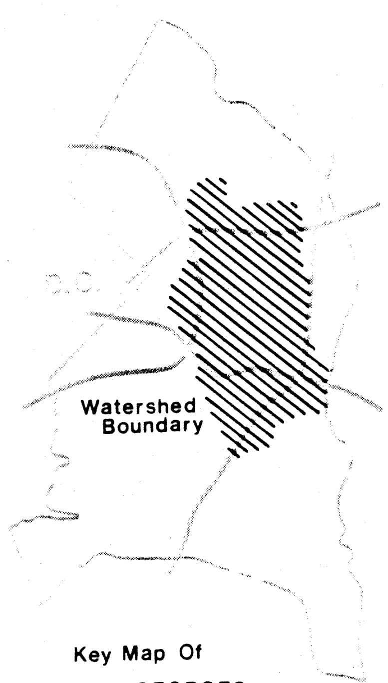
LEGEND

- Watershed Boundary
- Stream System
- Ponds



1 0 1 2 3 4 5

Scale In Miles



Key Map Of

PRINCE GEORGES COUNTY

WESTERN BRANCH WATERSHED

POND LOCATIONS

FIGURE 2

mammals. Old field habitat is usually generated by roadway construction, residential or agricultural development and this community should become more abundant as growth occurs within this watershed.

Cutover Areas-

Cutover areas represent the successional stage between old fields and woodland. They contain many of the same weedy plant species characteristic of old field habitat, but also have shining sumac (*Rhus copallina*), staghorn sumac (*Rhus typhina*), sassafras (*Sassafras albidum*), immature red maple (*Acer rubrum*), and other deciduous trees. The fauna is also similar to that of old field habitat except that the increased height and complexity of the vegetation provides suitable nesting sites for a greater diversity of birds. As with old field habitat, cutover areas generally become more prevalent as undisturbed regions develop and it is not expected that this community will become significantly less abundant in the future.

Deciduous Woodland-

As cutover areas mature the tree species gradually shade out the sun loving weedy forms. When this has happened, they become true deciduous woodland typified by the presence of mature trees and no ground cover, or only shade tolerant species such as greenbrier (*Smilax* sp.), various ferns and species of *Lycopodium*, and a number of orchids (*Cypripedium acaule*, *Goodyera pubescens*, *Aplectrum hymale*, *Tipularia discolor*) and other interesting wild flowers such as beech-drops (*Epifagus virginiana*), pipsissewa (*Chimaphila umbellata*), indian pipe (*Monotropa uniflora*), trailing arbutus (*Epigoea repens*), partridgeberry (*Mitchella repens*), trout lilly (*Erythronium americanum*), and skunk cabbage (*Symplocarpus foetidus*).

The composition of the over-story vegetation in different areas of the watershed varies considerably in response to local environmental conditions. In the bottomland forests occupying floodplains, the dominant trees are beech (*Fagus grandifolia*), tulip tree (*Liriodendron tulipifera*), red oak (*Quercus falcata*), sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), and river birch (*Betula nigra*). Poorly drained upland areas generally lack beeches and have a greater proportion of black gum (*Nyssa sylvatica*). In well drained upland regions, beeches are again common and oaks (*Quercus alba*, *Q. coccinea*, and *Q. velutina*) become dominant. Throughout the study area virginia pine (*Pinus virginiana*) is locally abundant, but is not dominant over a sufficiently extensive area for the recognition of coniferous woodland as a separate community.

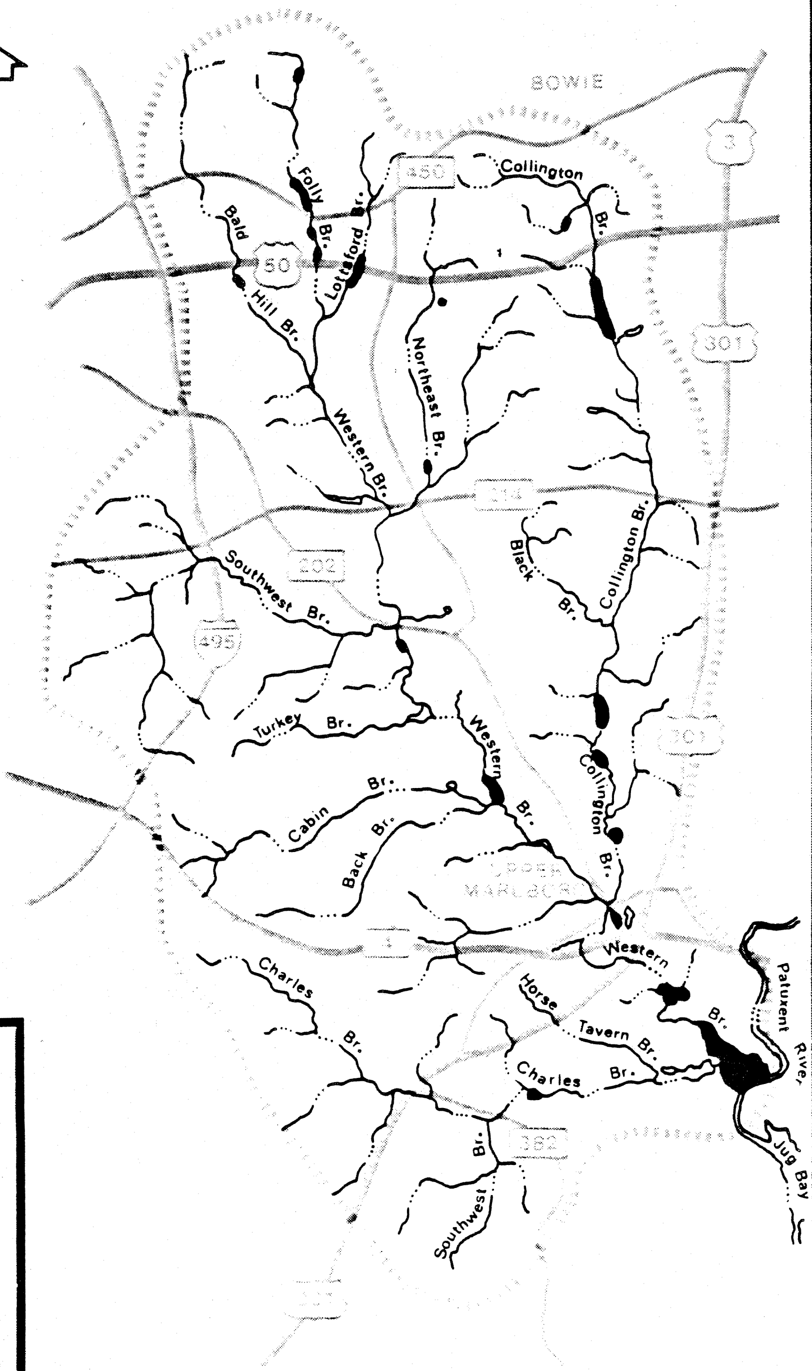
Although approximately 43 percent of the watershed remains wooded, additional woodland acreage is cleared each year and, due to the long regeneration period required for reforestation, its overall inventory within this area is decreasing. Since these wooded areas are of vital importance to local wildlife populations, produce beneficial hydrologic affects, and are aesthetically pleasing, their preservation should be a primary goal of any program to retain a balanced ecosystem within the Western Branch Watershed.

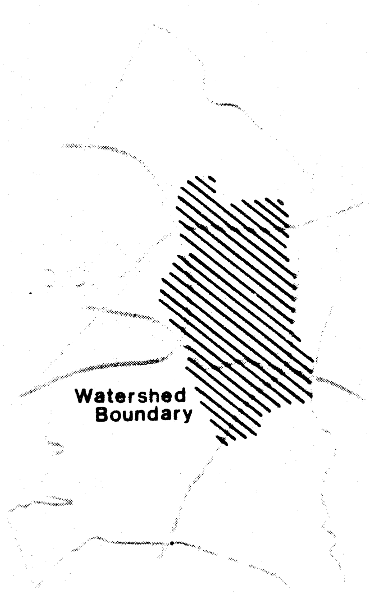
Wetlands-

Wetland areas occur throughout the watershed. They generally occupy the sites of shallow man-made ponds, seepage areas, or areas where streams become wide, shallow and slow flowing. These latter conditions frequently are found where roadways or railroad embankments have created artificial blockages, or the stream crosses nearly level, low lying areas of floodplain. A number of distinct types can be recognized according to differences in their physical characteristics and species of vegetation present. These wetland types are briefly described below, using the classification presented by Shaw and Fredine (1956) in U.S. Fish and Wildlife Service Circular 39. This typing scheme offers a standardized classification for wetlands throughout the United States and has gained wide acceptance.

Type 1, Seasonally Flooded Basins or Flats- These are found in upland depressions or along floodplain bottomlands where the soil is water-logged or covered by shallow water during highwater periods in spring, late fall or winter. Although these habitats are dry during summer, the soil is saturated long enough for wetland adapted plant species to occur. Within the study area this type of wetland is typically a deciduous woodland containing red maple, river birch and sweet gum. The fauna of these areas is generally similar to that of deciduous woodlands throughout the watershed. There is, however, a group of interesting amphibians that breed in transient pools and are largely restricted to these habitats. These species include spotted and marbled salamanders (*Ambystoma maculatum* and *A. opacum*), wood frogs (*Rana sylvatica*), and chorus frogs (*Pseudacris triseriata*). It has been suggested that these species require transient pools because they do not support predatory fish.

Type 3, Inland Shallow Fresh Marshes- These wetlands occur wherever permanently wet soils (water-logged or covered with as much as a foot of water throughout the growing season)





Key Map Of
PRINCE GEORGES
COUNTY

WESTERN BRANCH WATERSHED

SIGNIFICANT WETLAND AREAS

FIGURE 3

are found in open areas. The typical vegetation includes sedges (Carex sp.), rushes (Juncus sp.), cattails (Typha sp.), burrweed (Sparganium americanum), and arrowhead (Sagittaria ap.). These fresh marshes are inhabited by frogs (Acris crepitans, Rana catesbeina, R. clamitans, R. utricularia), aquatic reptiles (Natrix sipedon, Thamnophis sauritus, Chelydra serpentina, Chrysemys picta, Clemmys guttata), and numerous fishes.

Type 5, Inland Open Fresh Water- Shallow ponds that are not too turbid for plant growth are included in this type. In many instances, emergent and submerged vegetation is dense and includes water shield (Brasenia schreberi), water milfoil (Myriophyllum sp.), naids (Najas sp.), yellow pond lily (Nuphar luteum), water lily (Nymphaea odorata), pondweeds (Potamogeton sp.), and waterweed (Elodea sp.). A wide variety of fishes, amphibians, aquatic reptiles and waterfowl frequent these habitats. Particularly prevalent are painted turtles (Chrysemys picta), which may be observed basking in large numbers on logs and other objects. These ponds also support populations of largemouth bass (Micropterus salmoides), catfish (Ictalurus sp.), and various sunfish (Lepomis sp.) which provide opportunity for freshwater fishing.

Type 6, Shrub Swamp- Within the study area, shrub swamps have from several inches to a foot or more of water throughout the year and contain alders (Alnus serrulata), black willow (Salix nigra), buttonbush (Cephalanthus occidentalis), red willow (Cornus amomum), and swamp rose (Rosa palustris). These habitats support a wide variety of fishes, amphibians, aquatic reptiles, ducks, herons and other marsh birds. The only active beaver lodge found within the watershed occurred in a shrub swamp.

These four types of wetland were seldom found by themselves. Generally, two or three occurred together in complex vegetation patterns responding to varying topography and hydrologic regimes.

Wetlands provide habitat for a wide variety of plants and animals. Many of these species are specialized aquatic or amphibious forms that do not occur in other habitat types. In addition, these areas also play an important role in maintaining water quality and producing vegetative material. Wetlands in general, produce enormous quantities of vegetation. Some of this vegetation remains within the wetland, but much dies, breaks down, and is carried downstream where it provides a major source of energy for aquatic food chains that ultimately support crabs, oysters, fish and numerous other aquatic and terrestrial species. These vegetation packed wetlands also serve to trap silt and other pollutants before they can be deposited in open waterways. Additional information on the ecology of Maryland wetlands is given in Wetlands in Maryland (Metzgar 1973).

Wetlands have traditionally not been compatible with development and, in the past, many acres have been filled for landfill and construction activities or ditched and drained for agricultural production. However, with the increasing understanding of the beneficial qualities of these areas, preservation of wetlands has become a responsibility dictated by federal, state and local regulations. In fact, good planners now try to design around existing wetlands or even create new ones as part of storm water management systems since wetlands have been shown to decrease and slow runoff, and improve the quality of drainage from roadways or development sites.

Cultivated Land-

Approximately 36 percent of the watershed is intensively cultivated for the production of corn, tobacco, soy beans, and other crops. The value of these fields to local wildlife species varies according to the crop planted. No signs of wildlife were noted in tobacco fields, but tracks of deer and raccoons were frequently observed around corn fields and areas where vegetables were under cultivation. Corn and soy bean fields are also utilized during winter months by mourning doves and canada geese, and in the spring and fall by large flocks of mixed blackbirds (Icteridae).

Although this active agricultural land is of enormous economic importance, it also has adverse environmental impacts on the watershed. Wind and storm water carry large amounts of soil from these cultivated fields into adjacent streams. This increased sediment load increases turbidity and produces a covering of silt over the normal substrate (typically clay or sand and gravel). This silt layer drastically modifies the structure of the benthic community and significantly reduces the diversity of the resident fish population.

This eroden material also includes fertilizer and other nutrients that can generate excessive growth of phytoplankton and rooted aquatic plants. This is an ongoing problem and many ponds within the Western Branch Watershed support algal blooms during summer months. In addition to being unsightly and producing unpleasent odors, these blooms can reduce the amount of dissolved oxygen available to fish and other aquatic creatures to critical levels.

Significant Environmental Features

1. The major environmental features of the study area are the Western Branch drainage system and its associated floodplain. The floodplain includes a significant amount of the remaining woodland and most of the important wetland areas. Preservation of this floodplain in an undisturbed condition and continued maintenance of suitable water quality in Western Branch and its tributaries must be a primary goal of any program to retain a high degree of environmental quality within this watershed.

   Reports by various agencies have suggested that specific terrestrial sites within the Western Branch drainage should be preserved because of their environmental significance. The most notable of these is Belt Woods, a tract of mature deciduous woodland near the junction of Church Street and Route 214. Our survey showed that many limited tracts of very fine woodland exist within this watershed and we feel that singling out one of these would tend to divert public and agency attention from the others. We also feel that preservation of isolated woodland areas is less desirable than affording protection to more extensive areas, even if they are not as mature, since the larger areas are of comparatively greater environmental significance (i.e., wildlife carrying capacity, watershed benefits, natural buffers, etc.).

2. A number of significant wetland areas are distributed throughout this drainage system (see Figure 3). These areas are of vital importance and should be preserved. The largest wetland tract present, the extensive marsh at the mouth of Western Branch, is a tidal wetland and is fully protected by the Maryland Wetland Act of 1970. The other wetlands are afforded some protection by state and local building codes and other regulations. However, clearcutting and similar activities are generally not prohibited on private, non tidal wetlands.

Flora and Fauna

The Western Branch watershed exhibits considerable biotic diversity. Since species of animals and plants vary in their tolerance to environmental degradation or disturbance, knowledge of the local flora and fauna is useful in assessing the condition of a given area. For this reason, an intensive survey of selected groups of plants and animals present in the study area was undertaken. The selection of these groups was based on published information concerning their value as biotic indicators of environmental conditions, the existence of keys or other materials necessary for the identification of local species, and our own experience with each group. It should be noted that, while the groups surveyed include the more obvious forms, they do not necessarily include the majority of the species actually present. Due to limits on time and difficulty in obtaining reliable determinations, such "micro" groups as algae, arthropods and other invertebrates have not been included.

The groups that were surveyed are generally discussed below. Detailed lists of those species found within the watershed are given with notes on their abundance, distribution and habitat preferences or requirements. The nomenclature used follows the most readily available field guide or regional taxonomic treatment. These publications are cited where appropriate. None of the species reported here are beyond their expected range, and most have also been reported from the adjacent Patuxent Wildlife Research Center by Hotchkiss and Stewart (1979).

Fungi

Fungi, although not always conspicuous, are extremely important members of the flora of the Western Branch Watershed. These plants are either saprophytes, helping to break down organic matter, or parasites on living organisms, frequently trees or other species having substantial commercial value. Many of the local species are also edible and are eagerly sought by mushroom collectors. However, it should be noted that a number of toxic varities are present and the gathering of wild mushrooms should be left to collectors experienced in their identification. Miller (1972) provides a useful guide to the local species, including color photographs of the common varieties and information on their edibility.

Numerous species of fungi are present in the watershed. Most of these species are difficult to identify and no effort has been made to catalogue the entire flora. The following list includes the more obvious, showy forms that are most frequently encountered. All of these are easily identified when their fruiting structures are present. However, with the exception of the woody varieties, fruiting bodies are short lived and often seasonal. In the following entries, letter codes have been used to indicate the usual habitat (woodland= W, field=F, grassland=G) and substrate preference (trees=t, stumps or logs=s, soil or detritus=g) for each species.

Aleuria auranta- F,g
Amanita brunnescens- W,g
Amanita citrina- W,g
Amanita vaginata- W,g
Amillariella tabescens- W,s
Astreus hygrometricus- F,g
Cantharellus cinnabarinus- W,g
Clavaria sp.- W,g
Clitocybe aurantiaca- W,s
Conocybe lactea- G,g
Conocybe tenera- G,W,g
Coprinus disseminatus- W,s
Coprinus micaceus-W,s
Craterellus cornucopioides- W,g
Daedalia confragosa- W,t
Daldinia concentrica- W,t
Entoloma lividum- W,g
Fomes rimosus- W,t
Ganoderma applanatum- W,t
Hygrophorus nitidus- W,g
Hygrophorus russula- W,g
Marasmius rotula- W,s
Mycena haematopus- W,s
Panus stipticus- W,s
Pleurotus ostreatus- W,t
Polyporus cinnabarinus- W,s
Polyporus conchifer- Elm trees
Polyporus versicolor- W,s
Russula emetica- W,g
Russula xerampelina- W,s
Schizophyllum commune- W,t
Stereum frustulatum- W,g
Stereum gausapatum- W,t

Lichens

Lichens were collected at the following ten localities. As Figure 4 shows, these localities represent all general regions of the watershed. At each station, extensive collections of macro and crustose lichens were made from the trunks and branches of trees. These were identified with the keys given by Hale (1979), and voucher specimens were placed in the herbarium of Towson State University. The species present at each locality are identified in Table 1. Those species that were found to be sensitive to air pollution in Montogemery County by Skorepa and Windler (1977) are marked with an asterisk (*).

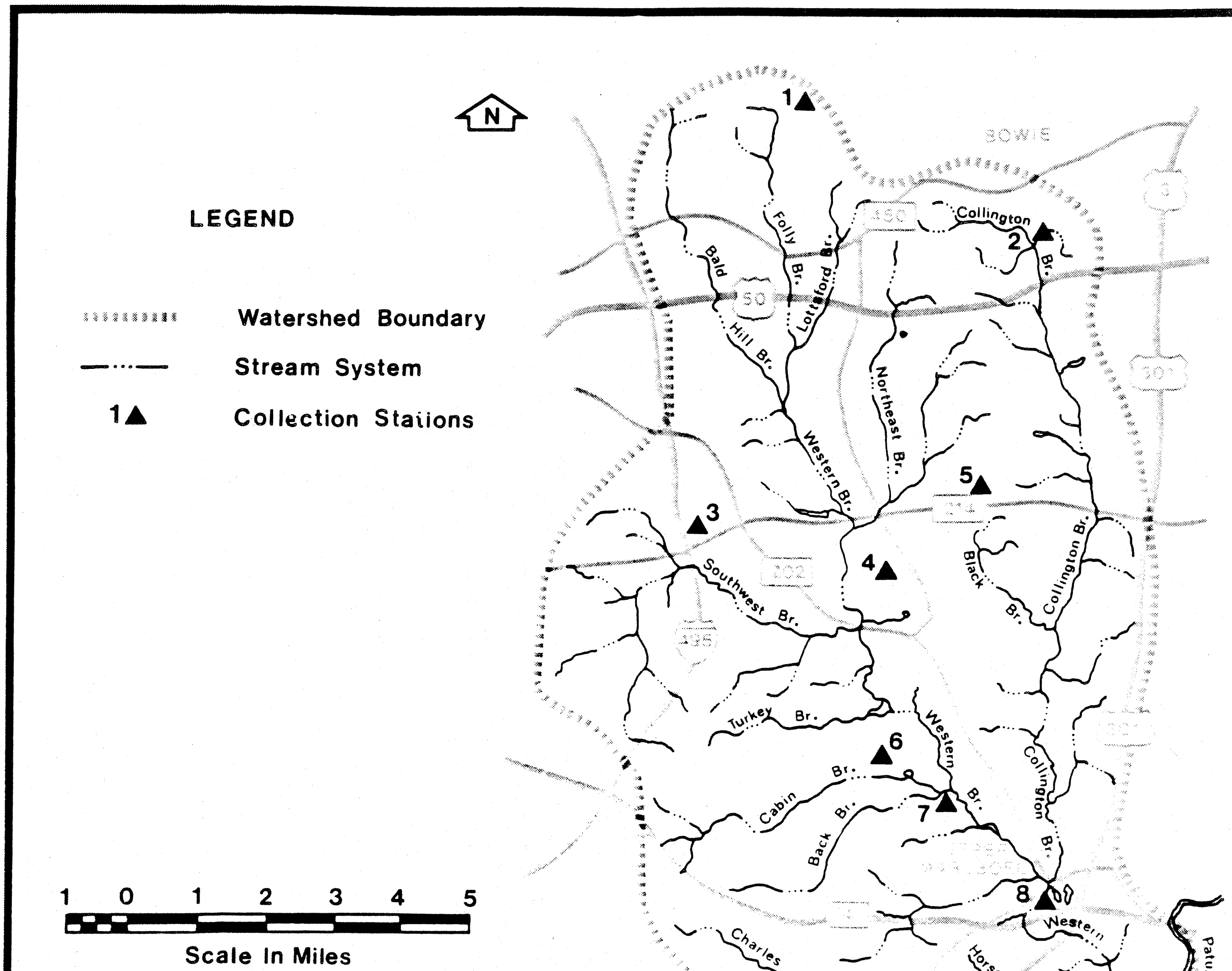
Collection Localities

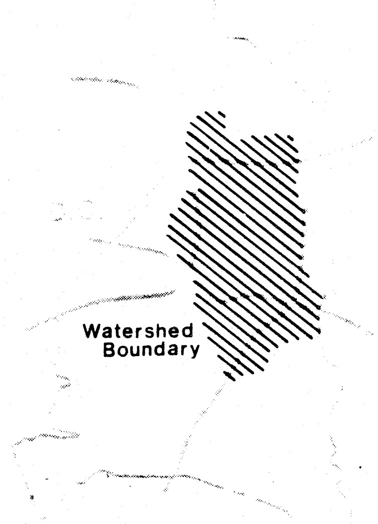
1. Mixed coniferous-deciduous woods along north side of Route 564, northeast of Glenn Dale.

2. Open deciduous woods along south side of pond at Fox Hill Recreation Area.

3. Moist deciduous woods around Capital Arena.

4. Moist deciduous woods in Watkins Regional Park.





Key Map Of
PRINCE GEORGES
COUNTY

WESTERN BRANCH WATERSHED

LICHEN COLLECTION STATIONS

FIGURE 4

5. Black oak trees at junction of Church and Woodmore Roads.

6. Black oak trees along Brown Station Road at landfill.

7. Woods along floodplain of Western Branch at mouth of Cabin Branch.

8. Upper Marlboro, woods in swamp around Depot Pond.

9. Moist deciduous woods in Rosaryville State Park.

10. Swamp along Charles Branch at Croom Station Road.

TABLE 1. Lichen species collected at ten locations within the Western Branch Watershed.

Species	Locality									
	1	2	3	4	5	6	7	8	9	10
*Anaptychia palmulata**					X	X		X		
*Arthonia caesia**								X		
Bacidia schweinitzii		X				X		X		X
Buellia punctata								X		
Buellia stillingiana	X	X		X	X		X	X	X	X
*Candelaria concolor**					X			X		
Cetraria ciliaris	X									
Cladonia caespticia		X		X	X	X	X	X	X	X
Cladonia coniocraea	X	X		X	X	X	X	X	X	X
Collema furfuraceum							X		X	
Graphis scripta	X	X	X	X	X	X	X	X	X	X
Heterodermia appalachensis				X	X		X	X	X	
Lecanora conizaea	X	X		X	X	X		X		
Lecanora subfusca		X						X		
Hypotrachyna livida		X		X	X	X		X		
Lepraria sp.	X	X	X	X	X	X	X	X	X	X
Leptogium cyanescens		X			X			X		
Ocrolechia parella	X									
Parmelia rudecta	X	X	X	X	X	X	X	X	X	X
*Parmelia subrudecta**		X			X			X		X
*Parmelia sulcata**					X	X		X		X
Parmelia aurulenta		X		X	X	X		X		X
Parmeliopsis aleurites	X									
Parmeliopsis placorodia	X									
Parmeliopsis subambigua	X									
Parmotrema cetratum								X		X
*Parmotrema hypotropum**		X	X		X	X	X	X	X	X
Parmotrema michauxianum								X		X
Parmotrema perforatum										X
*Pertusaria paratuberculifera**					X	X				X

TABLE 1. Continued

Species	Locality 1	2	3	4	5	6	7	8	9	10
*Pertusaria velata**					X					X
Pertusaria xanthodes		X	X	X	X	X		X		X
Phaeophyscia adiastola		X						X		X
Phaeophyscia rubropulchra	X	X	X	X	X	X		X	X	X
Physcia americana		X		X		X		X		X
Physcia millegrana	X	X	X	X	X	X	X	X	X	X
Physcia stellaris	X	X	X	X	X	X	X	X	X	X
Pyrenula nitida		X			X			X		X
Pyxine caesiopruinosa					X					X
Pyxine sorediata				X	X	X		X		X

Lichens are sensitive to sulphur dioxide and other common atmospheric pollutants. They also concentrate heavy metals, particulates and radioactive materials. These features make them useful indicators of air quality. Numerous studies have documented this and methodologies are well established. A review of the literature concerning the use of lichens as pollution indicators and monitors is given by Hawksworth and Rose (1976).

Some lichen species are more tolerant of air pollution than others. For this reason, the species composition of a given locality indicates, by the presence or absence of species of varying sensitivity, the relative quality of the atmospheric environment at that locality. The localities represented in Table 1 are generally numbered from north to south within the watershed (see Figure 4) and, as the following comparison shows, the greatest species diversity and concentration of known highly sensitive species tends to occur in the more southern areas. This indicates that air quality has deteriorated in the portions of the watershed that are more urbanized and closer to Washington, D.C.

Locality	Total Species Present	Highly Sensitive Species
1	14	0
2	21	1
3	8	1
4	16	0
5	25	6
6	19	4
7	11	1
8	30	6
9	12	1
10	25	3

Bryophytes

Mosses and liverworts are a conspicuous element of the epiphytic and forest floor communities in undeveloped portions of the watershed. Most species occupy relatively undisturbed areas and vanish when the over-story vegetation is removed or modifications in the hydrologic regime are induced. The following species are the dominant members of the local bryophyte flora, however, our collections contain a number of unidentified specimens and additional species are undoubtedly present. Conrad and Redfearn (1979) provide useful keys for the identification of these plants.

In the following list, each species has a series of letters which indicate its relative abundance (abundant=A, common=C, uncommon=U, rare=R), major habitat type (deciduous woodland=W, fields or other exposed areas=F, bogs or swamps=B, streams=S, ponds=P, temporary pools=T) and prefered substrate (free floating=f, soil=g, logs=l, tree roots=r, tree trunks=t, stone=s, stone walls=w). All of these species occur throughout the watershed, wherever suitable habitat and substrate is present.

Mosses

Anomodon attenuatus- C,W,t
Aulacomnium palustre- C,B,g
Bryum argenteum- U,W,g,w
Ceratodon purpureus- C,F,g
Dicranella heteromalla- U,W,F,g
Entodon seductrix- C,W,g,t
Fontinalis sp.- U,S,r,s
Funaria hygrometrica- U,W,g
Grimmia apocarpa- C,W,g
Hypnum sp.- U,W,s
Leucobryum glaucum- C,W,g,l,r
Platygyrium repens- C,W,B,g
Sphagnum sp.- C,W,B,g
Thuidium delicatulum- U,W,g,l,r

Liverworts

Frullania eboracensis- A,W,l,r,t
Lophocolea heterophylla- C,W,g,l,t
Marchantia polymorpha- U,S,g
Porella sp.- U,W,l,r
Riccia fluitans- R,B,T,f,g

Vascular Plants

Vascular plants were examined at numerous localities throughout the Western Branch Watershed. Selected sites representing typical examples of all major habitat types present were visited at regular intervals from early spring to late fall so that species of seasonal occurrence could be obtained. All species present at each locality were identified in the field or collected for further study.

Although 374 species were identified during this survey, additional effort would expand this list considerably. An extensive study of the vascular flora of the nearby Patuxent Wildlife Research Center (Hotchkiss and Stewart, 1979) revealed 875 species to be present. Since the Western Branch Watershed is larger and ecologically more diverse than the Patuxent facility, it can be expected to support an equal or greater number of vascular plant species.

Because this list is lengthy, it has been divided into several subsections for manageability and to reflect the availability of local systematic treatments. These three subsections (ferns and fern allies; trees, shrubs and woody vines; herbaceous plants) are introduced below, followed by the species lists. The nomenclature used here follows Radford, Ahles and Bell (1968).

Ferns and Fern Allies

Twenty five species of ferns and fern allies were found within the watershed. These species are generally distributed throughout the study area and in some localities, particularly ravines or moist bottomlands in mature deciduous woods, are a major component of the ground cover. Most of these species require moist to wet conditions with over-story vegetation and, when woodlands are cut or the water table is significantly lowered, quickly die out. A useful guide to the ferns and fern allies of this region has been given by Reed (1953). In addition to keys and illustrations of all local species, Reed provides dot maps depicting the known Maryland distribution of each.

In this list, the name of each species is followed by a series of letters which indicate its relative abundance (abundant=A, common=C, uncommon=U, rare=R) and major habitat type (deciduous woods=D, swamps and bogs or other wet areas=S, fields and other exposed areas=F). In addition to these species found by us, Reed (1953) has also reported adders-tongue fern (*Ophioglossum vulgatum*), grape fern (*Botrychium matricariaefolium*), ostrich fern (*Pteris pensylvanica*), bog fern (*Dryopteris simulata*), bog clubmoss (*Lycopodium undulatum*), running clubmoss (*Lycopodium clavatum*), and the quilwort (*Isoetes engelmanni*) from within or directly adjacent to the watershed.

Cut-leaved grape fern (*Botrychium dissectum*)- C,D
Rattlesnake fern (*Botrychium virginianum*)- C,D
Royal fern (*Osmunda regalis*)- U,S
Cinnamon fern (*Osmunda cinnamonea*)- U,D,S

Bracken fern (Pteridium aquilinum)- A,F
Hay-scented fern (Dennstaedtia punctilobula)- U,D
Sensitive fern (Onoclea sensibilis)- C,D,S
Silvery spleenwort (Athyrium thelypteroides)- U,D
Lady fern (Athyrium felix-femina)- C,D
Marginal shield fern (Dryopteris marginalis)- C,D
Crested shield fern (Dryopteris cristata)- U,D,S
Spinulose wood fern (Dryopteris spinulosa)- U,D
New York fern (Dryopteris noveboracensis)- C,D,S
Marsh fern (Dryopteris thelypteris)- C,S
Broad beech fern (Dryopteris hexagonoptera)- U,D
Christmas fern (Polystichum acrostichoides)- A,D
Ebonystem spleenwort (Asplenium platyneuron)- C,D
Narrow-leaved chain fern (Lorinseria areolata)- U,S
Shining clubmoss (Lycopodium lucidulum)- U,d
Groundpine (Lycopodium obscuratum)- U,D
Running pine (Lycopodium complanatum)- U,D
Meadow spikemoss (Selaginella apoda)- R,S
Field horsetail (Equisetum arvense)- C,F,S
Scouring rush (Equisetum hyemale)- U,F

Trees, Shrubs and Woody Vines

These species are the dominant forms of wooded and cutover habitats throughout the watershed. Many are of considerable economic importance, and collectively they are vital to the overall ecology of this region. An excellant illustrated guide to the identification of the local species is given by Brown and Brown (1972). Many of these plants are not native to Maryland and some are only represented by isolated specimens planted as ornamentals (bald cypress and white pine) or escaped from cultivation and now reproducing naturally at specific locations (fig and kudzu). Others, however, are fairly common and well distributed throughout the study area (mimosa, osage orange, japanese honeysuckle).

In the following list, the name of each species is followed by a series of letters which indicate its relative abundance (abundant=A, common=C, uncommon=U, rare=R) and major habitat type (deciduous woods=d, mixed deciduous-coniferous woods-m, upland deciduous woods=u, lowland deciduous woods=l, swamps and bogs or other wet areas=b, roadsides=r, cutover areas=c, edges of woodlands=e, fields=f, banks of streams=s, planted as ornimentals=o).

Pinaceae
- White pine (Pinus strobus)- R,o
- Loblolly pine (Pinus taeda)- R,o
- Virginia pine (Pinus virginiana)- C,m

Taxodiaceae
- Bald cypress (Taxodium distichum)- R,o

Cupressaceae
   Red cedar (Juniperus virginiana)- U,r,f
Liliaceae
   Glaucous greenbriar (Smilax glauca)- C,d,e
   Common greenbriar (Smilax rotundifolia)- A, d,c,e
Salicaceae
   Black willow (Salix nigra)- C,b,s
   Weeping willow (Salix babylonica)- U,b,s
   Pussy willow (Salix discolor)- U,b,s
   White poplar (Populus alba)- R,o
   Swamp cottonwood (Populus heterophylla)- U,l,b,s
Myricaceae
   Sweet fern (Comptonia peregrina)- R,b
Juglandaceae
   Bitternut hickory (Carya cordiformis)- Ul
   Pignut hickory (Carya glabra)- Ud
   Shagbark hickory (Carya ovata)- U,u
   Mockernut hickory (Carya tomentosa)- C,d
   Black walnut (Juglans nigra)- U,d
Betulaceae
   Smooth alder (Alnus serrulata)- S,b,s
   River birch (Betula nigra)- C,l,s
   Ironwood (Carpinus caroliniana)- U,l
   American hazelnut (Corylus americana)- U,l
Fagaceae
   Beech (Fagus grandifolia)- C,d
   American chestnut (Castania dentata)- R, d, sprouting from old stumps.
   White oak (Quercus alba)- Cu
   Swamp white oak (Quercus bicolor)- U,b,s
   Scarlet oak (Quercus coccinea)- C,d
   Southern red oak (Quercus falcata)- C,d
   Black jack oak (Quercus marilandica)- R,u
   Swamp chestnut oak (Quercus michaixii)- U,l,s
   Pin oak (Quercus palustris)- C,l
   Willow oak (Quercus phellos)- C, l,b
   Black oak (Quercus velutina)- C,u
Ulmaceae
   Hackberry (Celtis occidentalis)- R,c
   American elm (Ulmus americana)- U,c
Moraceae
   Fig (Ficus carica)- R,r
   Osage orange (Maclura pomifera)- U,r
   Red mulberry (Morus rubra)- U,l,r
Ranunculaceae
   Leather flower (Clematis viorna)- U,r,c
   Virgin's-bower (Clematis virginiana)- U,r,c
Berberidaceae
   Barberry (Berberis thunbergii)- R,c,f

Magnoliaceae
   Tulip tree (*Liriodendron tulipifera*)- A,d
   Swamp magnolia (*Magnolia virginiana*)- U,l
Annonaceae
   Pawpaw (*Asimina triloba*)- U,l,s
Lauraceae
   Spicebush (*Lindera benzoin*)- C,l
   Sassafras (*Sassafras albidum*)- C,r,c,f
Saxifragaceae
   Wild hydrangia (*Hydrangia arborsecens*)- R,s
   Sweet spires (*Itea virginica*)- R,b
Hamamelidaceae
   Witch-hazel (*Hamamelis virginiana*)- U,d
   Sweet gum (*Liquidambar styraciflua*)- A,l,b
Platanaceae
   Sycamore (*Platanus occidentalis*)- C,l
Rosaceae
   Swamp serviceberry (*Amelanchier canadensis*)-lC,c,s
   Wild cherry (*Prunus serotina*)- C,r,c
   Pasture rose (*Rosa carolina*)- C,r,c
   Multiflora rose (*Rosa multiflora*)- C,r,c,f
   Swamp rose (*Rosa palustris*)- C,b
   Highbush blackberry (*Rubus allegheniensis*)- C,r,c
   Common dewberry (*Rubus flagellaris*)- U,c,f
   Swamp dewberry (*Rubus hispidus*)- C,c,s
   Black raspberry (*Rubus occidentalis*)- U, d,c,f
   Chokeberry (*Sorbus arbutifolia*)- U,s
   Meadow-sweet (*Spiraea alba*)- U,b
   Steeple-bush (*Spiraea tomentosa*)- U,s
Fabaceae
   Mimosa (*Albizzia julibrissin*)- U,r,c
   Redbud (*Cercis canadensis*)- U,u
   Kudzu (*Pueraria lobata*)- R,r
   Black locust (*Robinia pseudoacacia*)- A,r,c
   Wisteria (Wisteria frutescens)- R, c,f
Simaroubaceae
   Tree-of-heaven (*Ailanthus altissima*)- R,r,c
Anacardiaceae
   Smooth sumac (*Rhus glabra*)- C,r,c
   Dwarf sumac (*Rhus copallina*)- C,r,c
   Poison ivy (*Rhus radicans*)- A,r,c,e,f
   Staghorn sumac (*Rhus typhina*)- U,r,c
Aquifoliaceae
   American holly (*Ilex opaca*)- C, d,b
   Winterberry (*Ilex verticillata*)- U,b,c
Celastraceae
   Bittersweet (*Celastrus scandens*)- U,r,f
   Strawberry bush (*Euonymus americanus*)- U,l
Aceraceae
   Box elder (*Acer negundo*)- C,l,c
   Red maple (*Acer rubrum*)- A, l,b,c
   Silver maple (*Acer saccharinum*)- U,l

Rhamnaceae
New Jersey tea (*Ceanothus americanus*)- R,c
Vitaceae
Virginia creeper (*Parthenocissus quinquefolia*)- C,c,l
Summer grape (*Vitis aestivalis*)- C,l
Fox grape (*Vitis labrusca*)- C,r,c,e
Winter grape (*Vitis vulpina*)- U,l
Malvaceae
Rose-of-Sharon (*Hibiscus syriacus*)- U,c,o
Nyssaceae
Black gum (*Nyssa sylvatica*)- C,l
Araliaceae
Devil's walking stick (*Aralia spinosa*)- C,l,c,e
Cornaceae
Red willow (*Cornus amomum*)- C,l,s
Flowering dogwood (*Cornus florida*)- C,d,c
Clethraceae
Sweet pepperbush (*Clethra alnifolia*)- C,b,c
Ericaceae
Black huckleberry (*Gaylussacia baccata*)- C,u
Dangleberry (*Gaylussacia frondosa*)- C,d
Mountain laurel (*Kalmia latifolia*)- U,u
Sweetbells (*Leucothoe racemosa*)- C,b,c
Male-berry (*Lyonia lingustrina*)- U,b,c
Pink azalea (*Rhododendron nudiflorum*)- U,u
White swamp azalea (*Rhododendron viscosum*)- U,b
Highbush blueberry (*Vaccinium corymbosum*)- U,b,c
Deerberry (*Vaccinium stamineum*)- U,u
Low blueberry (*Vaccinium vacillans*)- C,u
Ebenaceae
Persimmon (*Diaspyros virginiana*)- U,r,c,e
Oleaceae
White ash (*Fraxinus americana*)- U,l
Red ash(*Fraxinus pennsylvanica*)- U,d,s
Fringe tree (*Chionanthus virginicus*)- U,l
Scrophulariaceae
Princess tree (*Paulownia tomentosa*)- U,r,c,e
Bignoniaceae
Trumpet-creeper (*Campsis radicans*)- C,r,c,e
Cigar tree (*Catalpa speciosa*)- U,r
Rubiaceae
Buttonbush (*Cephalanthus occidentalis*)- C,b
Caprifoliaceae
Japenese honeysuckle (*Lonicera japonica*)- A,d,r,e,f
Elderberry (*Sambucus canadensis*)- U,r,e,f
Maple-leaved viburnum (*Viburnum acerifolium*)- U,d
Swamp viburnum (*Viburnum nudum*)- U,b,s
Black-haw (*Viburnum prunifolium*)- U,l,s
Arrow-wood (*Viburnum recognitum*)- U,b,s

Herbaceous Plants

A vast variety of plant species are grouped in the following list under this subheading. These plants are vital to the study area as ground cover to stabilize soil against erosion and provide food, cover and nesting places for numerous species of animals. Many of these plants can be difficult to identify, particularly some belonging to the Poaceae, Cyperaceae and Asteraceae. The best available treatment of the local flora is given by Radford, Ahles and Bell (1968), although various wildflower guides and other popular publications are also helpful.

The letter codes used below to denote relative abundance and major habitat type are the same as those previously cited for Trees, Shrubs and Woody Vines, except that one additional habitat category has been added for aquatic (=a) species.

Typhaceae
- Typha angustifolia- U,b
- Typha latifolia- A,b

Sparganiaceae
- Sparganium americanum- A,b

Potamogetonaceae
- Potamogeton diversifolius- U,a
- Potamogeton epihydrus- R,a
- Potamogeton pulcher- U,a
- Potamogeton pusillus- R,a

Najadaceae
- Najas sp.- U,a

Alismaceae
- Alisma subcordatum- U,b,s
- Sagittaria latifolia- U,b,s

Hydrocharitaceae
- Elodea nuttallii- R,a

Poaceae
- Agropyron repens- C,r,f
- Agrostis perennans- U,r,f
- Aira elegans- U,r,f
- Andropogon sp. C,r,f
- Aristidia dichotoma- U,r,f
- Aristidia longespica- U,r,f
- Cinna arundinacea- C,d,b
- Danthonia spicata- C,r,f
- Digitaria ischaemum- A,r,f
- Digitaria filiformis- U,r,f
- Digitaria sanguinalis- U,r,f
- Eragrostis spectablis- U,r,f
- Elymus virginicus- R,r,f
- Festuca obtusa- R,d
- Festuca octoflora- U,r,f
- Leersia oryzoides- C,b
- Leersia virginica
- Manisuris rugosa- U,r
- Muhlenbergia schreberi- U,r,f
- Panicum clandestinum- C,r,f
- Panicum depauperatum- U,r,f
- Panicum dichotomiflorum- U,f
- Panicum polyanthes- U,r,f
- Paspalum laeve- U,r,f
- Paspalum setaceum- U,r,f
- Phragmites communis- U,b,f
- Poa annua- C,f
- Poa pratensis- C,f
- Poa sylvestris- U,r,d
- Setaria glauca- C,r,f
- Triodia flava- C,r,f
- Zea mays- C,r,f

Cyperaceae
- Carex crinita- C,b
- Carex folliculata- C,b
- Carex incomperta- C,b
- Carex lupulina- C,b
- Carex lurida- C,b
- Carex scoparia- C,b
- Carex stricta- C,b
- Carex swanii- C,b
- Cyperus ovularis- U,r,f
- Cyperis strigosus- U,b
- Eleocharis obtusa- C,b
- Eleocharis tenuis- U,b
- Rhynchospora sp.- U,b

Scirpus americanus- U,b,s
Scirpus cyperinus- U,b

Araceae
- Acorus calamus- C,b
- Arisaema triphyllum- C,d
- Orontium aquaticum- R,b
- Peltandra virginica- R,b
- Symplocarpus foetidus- A,d,b

Lemnaceae
- Lemna sp.- A,a
- Wolffia sp.- W,a

Xyridaceae
- Xyris caroliniana- Rd,b,f

Commelinaceae
- Commelina communis- U,r,e
- Tradescantia ohiensis- U,r,f

Pontederiaceae
- Pontederia cordata- U,b

Juncaceae
- Juncus acuminatus- C,b
- Juncus effusus- C,b
- Juncus scirpoides- C,b

Liliaceae
- Allium canadense- R,f
- Allium vineale- R,f,e
- Asparagus officinalis- R,f,e
- Erythronium americanum- U,d
- Hemerocallis fulva- Ub,s
- Medeola virginiana- C,d
- Ornithogalum umbellatum- R,r,f
- Polygonatum biflorum- U,d
- Smilacina racemosa- C,d

Loranthaceae
- Phoradendron serotinum- R,l

Dioscoreaceae
- Dioscorea villosa- R,d

Amaryllidaceae
- Hypoxis hirsuta- R,e,f
- Narcissus pseudo-narcissus- R,f

Iridaceae
- Sisyrinchium angustifolium- R,b

Orchidaceae
- Aplectrum hyemale- R,d
- Cypripedium acaule- R,d
- Goodyera pubescens- R,d
- Spiranthes cernua- U,b
- Tipularia discolor- R,d

Saururaceae
- Saururus cernuus- U,b,s

Urticaceae
- Laportea canadensis- A,d
- Urtica dioica- R,f

Polygonaceae
- Polygonum arifolium- U,s
- Polygonum aviculare- C,r,f
- Polygonum natans- C,b
- Polygonum pensylvanicum- C,b,f
- Polygonum sagittatum- C,b,f
- Polygonum setaceum- R,f
- Polygonum cuspidatum- R,r
- Rumex acetosella- A,r,f
- Rumex obtusifolius- R,f

Chenopodium
- Chenopodium album- A,r,f

Phytolaccaceae
- Phytolacca americana- C,r,f

Aizoaceae
- Mollugo verticillata- C,r,f

Portulacaceae
- Claytonia virginica- C,d

Caryophyllaceae
- Dianthus armeria- U,r,f
- Lychnis alba- C,r,f
- Stellaria media- C,r,f

Nymphaeaceae
- Nuphar luteum- C,a
- Nymphaea odorata- U,a

Cabombaceae
- Brasenia schreberi- U,a

Ranunculaceae
- Ranunculus abortivus- U,l
- Ranunculus acris- C,r,f
- Ranunculus bulbosus- U,r,f

Berberidaceae
- Podophyllum peltatum- A,d

Brassicaceae
- Barbarea verna- C,r,f
- Barbarea vulgaris- C,r,f
- Capsella bursa-pastoris- C,f
- Cardamine hirsuta- C,r,f
- Draba verna- C,r,f
- Lepidium campestre- C,r,f
- Lepidium virginicum- C,r,f
- Nasturtium officinale-R,b,s

Rosaceae
- Fragaria virginiana- U,r,f
- Geum canadensis- U,l

Potentilla canadensis- C,r,f
Potentilla simplex- C,r,f

Fabaceae
Desmodium nudiflorum- C,d
Lespedeza cuneata- U,r,f
Trifolium agrarium- U,r,f
Trifolium arvense- U,r,f
Trifolium pratense- C,f
Trifolium repens- U,f
Glycine max- C,f

Oxalidaceae
Oxalis europea- R,e,f
Oxalis stricta- C,r,f

Euphorbiaceae
Euphorbia corrolata- C,r,f

Callitrichaceae
Callitriche heterophylla- U,a

Balsaminaceae
Impatiens biflora- C,d,b
Impatiens pallida- R,d,b

Violaceae
Viola affinis- U,d
Viola lanceolata- R,b
Viola papilionacea- U,b
Viola primulifolia- U,b
Viola sagittata- C,e,f

Melastomaceae
Rhexia marina- U,b

Onagraceae
Ludwigia alternifolia- U,f,b
Ludwigia palustris- U,f,b
Oenothera biennis- C,r,f

Haloragaceae
Myriophyllum sp.- A,a

Apiaceae
Daucus carota- A,r,f
Hydrocotyle umbellata- C,b,a
Sanicula canadensis- U,d,c,b
Thaspium barbinode- U,l,s

Ericaceae
Chimaphila umbellata- C,d
Epigaea repens- U,d
Monotropa uniflora- C,d

Primulaceae
Lysimachia quadrifolia- C,b,e

Gentianaceae
Bartonia virginica- R,d
Sabatia angularis- R,b

Asclepiadaceae
Asclepias syriaca- A,r,f
Asclepias tuberosa- U,r,f

Convolvulaceae
Calystegia sepium- C,r,f
Convolvulus arvensis- U,f
Cuscuta campestris- C,f
Cuscuta compacta- C,b,f
Ipomoea hederacea- C,r,f
Ipomoea purpurea- C,r,f

Boraginaceae
Mertensia virginica- U,l

Verbenaceae
Verbena hastata- U,b
Verbena urticaefolia- R,r,f

Lamiaceae
Mentha piperita- C,e
Monardia didyma- U,f,b

Solanaceae
Datura stramonium- U,r,f
Nicotiana tabacum- U,f
Solanum americanum- R,r,f
Solanum carolinense- C,r,f

Scrophulariaceae
Chelone glabra- U,b,s
Verbascum thapsus- C,r,f

Orobanchaceae
Epifagus virginiana- U,d

Lentibulariaceae
Utricularia sp.- C,a

Plantaginaceae
Plantago aristata- U,r,f
Plantago lanceolata- U,r,f
Plantago major- U,r,f
Plantago rugelii- C,r,f
Plantago virginica- C,r,f

Rubiaceae
Galium aparina- U,r,f
Galium hispidum- U,f
Houstonia caerulea- C,d,b
Mitchella repens- U,d

Campanulaceae
Lobelia cardinalis- U,b
Lobelia inflata- R,e,f
Lobelia puberula- R,b,f

Asteraceae
Achillea millefolium- A,r,f
Ambrosia artemisiifolia- A,r,f
Ambrosia trifida- A,r,f
Antennaria plantaginifolia- C,f
Aster leavis- U,e,f
Aster novae-angliae- U,b
Aster pilosus- C,r,f
Aster puniceus- U,b

Bidens bipinnata- U,r,f
Bidens frondosa- U,r,f
Chrysanthemum leucanthemum- U,f
Cichorium intybus- A,r,f
Carduus arvensis- U,r,f
Carduus discolor- R,r,f
Elephantopus caroliniansus- R,e,s
Erigeron annus- U,r,f
Eupatorium album- R,f
Eupatorium perfoliatum- U,b,s
Eupatorium purpureum- A,r,f
Gnaphalium obtusifolium- U,f
Helianthus annuus- R,r,f
Helianthus tuberosus- R,r,f
Rudbeckia hirta- U,r,f
Senecio aureus- U,l,b
Senecio vulgaris- U,r,f
Solidago altissima- C,r,f
Solidago erecta- U,r,f
Solidago juncea- C,r,f
Solidago odora- R,r,f
Taraxacum officinale- C,f

Fish

In order to determine the composition of the fish fauna of the Western Branch Watershed, a collecting program was under taken during the summer of 1979 to sample the mainstream, all major tributaries and several permanent ponds. Collecting sites were selected to include a wide variety of aquatic habitat types. These sites are identified below and their locations are shown on Figure 5.

Collection localities

1. Tributary of Folly Branch along Glenn Dale Road; vegetation choked ditch with nearly stagnant water.

2. Folly Branch between Routes 450 and 704; slow flowing stream with Nuphar and Sparganium.

3. Large pond adjacent to Fox Hill Recreation Center; nearly stagnant, turbid water with dense growth of Nuphar and Myriophyllum.

4. Western Branch at Lottsford Road; slow flowing, turbid water with logs, sticks and detritus.

5. Tributary of Southwest Branch crossing Route 214 just west of Brightseat Road; slow flow of water through concrete channel with several inches of silt and dense growth of Typha and Salix.

6. Western Branch at Route 214; slow flowing, turbid water with logs, sticks and detritus.

7. Collington Branch at Route 214; slow flowing, turbid water with logs, sticks and detritus.

8. Southwest Branch at White House Road; moderate flow of clear water over gravel riffle with deep pool, large chunks of concrete and other debris under bridge.

9. Collington Branch at Leeland Road; moderate flow of turbid water over shifting sand.

10. Cabin Branch at Mellwood Road; slow flowing, clear water over shifting sand.

11. Cabin Branch at Brown Station Road; moderate flow of clear water over shifting sand, deep pool under bridge.

12. Western Branch at Water Street; moderate flow of turbid water over rocky riffle with deep pool.

13. Charles Branch at Trumps Hill Road; moderate flow of clear water over shifting sand.

14. Western Branch approximately 1.5 miles above its mouth; wide, tidal portion of stream with turbid water over sand and silt.

15. Western Branch at mouth; wide, tidal portion of stream with turbid water over sand and silt.

At each of these localities except 14 and 15, fish were collected with a twelve foot, eighth inch mesh seine. Due to their size, localities 14 and 15 were sampled with a fifty foot seine and gill net. A list of species obtained at each site is given in the following table with an estimate of their relative abundance at the time of collection (abundant=A, common=C, uncommon=U, rare=R). Useful illustrated keys for the identification of local species are given by Davis (1974) and Eddy (1969).

TABLE 2. Fish species collected at 15 locations within the Western Branch Watershed.

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
American brook lamprey (*Lampetra lamottenii*)				U		R		R							
Least brook lamprey (*Okkelbergia aepyptera*)				U		U		R	R		R				
Americal eel (*Anguilla rostrata*)	R			R				U	R		R	R		R	
Blueback herring (*Alosa aestivalis*)														C	C
Gizzard shad (*Dorosoma cepedianum*)						R					R	R			R
Eastern mudminnow (*Umbra pygmae*)	C	C	U	U	R										

TABLE 2. Continued.

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Redfin pickerel (*Esox americanus*)	R		U												
Chain pickerel (*Esox niger*)	R														
Goldfish (*Carassus auratus*)	R		R												
Carp (*Cyprinus carpio*)			R											C	R
Rosyside dace (*Clinostomus funduloides*)						R		R			C				
Eastern silvery minnow (*Hybognathus regius*)											R			U	U
Golden shiner (*Notemigonus crysoleucas*)	C	U	C			U	C		U						
Satinfin shiner (*Notropis analostanus*)						U	U	C	U	U	A	C			
Ironcolor shiner (*Notropis chalybaeus*)	R														
Common shiner (*Notropis cornutus*)								R							
Spottail shiner (*Notropis hudsonius*)												A		C	C
Swallowtail shiner (*Notropis procne*)		U	R	R		C	U	A	C	C	A	C	C		R
Blacknose dace (*Rhinichthys atratulus*)		R		R		U	U	A	U	C	A	C	A		
Creek chub (*Semotilus atromaculatus*)		U		U		R		C	R		C	U			
Fallfish (*Semotilus corporalis*)		R					R	U			R				
White sucker (*Catostomus commersoni*)		U	R				R	U			U	R			
Creek chubsucker (*Erimyzon oblongus*)	U		R												
White catfish (*Ictalurus catus*)														U	U
Yellow bullhead (*Ictalurus natalis*)	U														
Brown bullhead (*Ictalurus nebulosus*)	U		R									U			
Channel catfish (*Ictalurus punctatus*)														A	C
Tadpole madtom (*Noturus gyrinus*)	U						R	U							
Margined madtom (*Noturus insignis*)											R				
Pirate perch (*Aphredoderus sayanus*)	C	R				R									

TABLE 2. Continued

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mosquito fish (*Gambusia affinis*)			R												
Bluespotted sunfish (*Enneacanthus gloriosus*)	C	U	R												
Redbreast sunfish (*Lepomis auritus*)												R			
Pumpkinseed (*Lepomis gibbosus*)	U	U	C	R		R		U				U			
Bluegill (*Lepomis macrochirus*)	U	U	A	R		R	R	U	R		R	C			
Largemouth bass (*Micropterus salmoides*)	U		R												
White crappie (*Pomoxis annularis*)			R									R			
Black crappie (*Pomoxis nigromaculatus*)	R														
Swamp darter (*Etheostoma fusiforme*)	U		R						R						
Tessellated darter (*Etheostoma olmstedi*)	C	C	U			C	U	A	C	U	A	C	C		
White perch (*Marone americana*)												U		U	C

Plankton samples were also taken at localities 9, 11, 12, 14 and 15 during April 1979 to detect the presence of eggs or larvae of anadromous fishes. A plankton drift net (nylon mesh of 28 X 50 per square inch) mounted on a 15 inch square frame was placed in the stream for 10 minutes at each site and allowed to collect material carried by the current. The net was placed at midstream and held stationary where the water depth was less than 15 inches. Where the water depth was greater than 15inches the net was periodically shifted up and down to sample the entire water column. The contents of each net collection were preserved in formalin and returned to the laboratory for examination. This procedure is similar to the method used successfully by the Maryland Fisheries Administration in their anadromous fish survey program.

Fourty one species of fresh or brackish water fishes were collected within the Western Branch Watershed during this survey. According to Lee, Norden, Gilbert and Franz (1976), about twelve other freshwater species could be expected to occur in this region. All of these, however, are either "rare or restricted" or occupy habitat types not provided by Western Branch or its tributaries.

Although the existing fish fauna of the watershed is well diversified, the species diversity at several collecting sites was unexpectedly low. All of these sites exhibited a substrate of shifting sand or silt and lacked rocky riffles or in-stream vegetation. The low number of species present in these locations appears to be a response to lack of habitat diversity since the number of resident species increases significantly where rocky substrates or vegetation is present. These low diversity sites typically contained only species that occupy the free water column (Satinfin shiner, Swallowtail shiner, Blacknose dace) or inhabit sandy substrates (Tesselated darter). Extensive sedimentation results in the shifting sand or silt substrates present at these sites.

Two anadromous species (Blueback herring and White perch) were collected in the tidal portion of Western Branch. However, no evidence was found of their penetration above the riffle beneath the bridge at Water Street in Upper Marlboro, and no eggs or larvae of any anadromous species were recovered from the plankton samples. Similar results were also obtained by the Maryland Fisheries Administration when they investigated Western Branch in the course of their Anadromous Fish Survey Program. Apparently, these important species are not reproducing within this watershed. The reason for this is not known. The presence of numerous juvenile specimens of non-anadromous species indicates that water quality and other conditions throughout most of the watershed are suitable. It is possible that the riffle at Water Street poses a barrier to the upstream migration of anadromous fishes.

The freshwater fish fauna of this watershed is generally healthy and can be retained if good water quality can be maintained and sedimentation can be controlled.

Amphibians

The amphibians known to occur within the watershed are generally found wherever suitable water bodies or breeding places are present. Consequently, few are limited to any of the specific habitat types identified in this document. There is, however, an interesting association of species that typically breeds in transient pools in deciduous woods. These species, the spring peeper (*Hyla crucifer*), chorus frog (*Pseudacris triseriata*), wood frog (*Rana sylvatica*), marbled salamander (*Ambystoma opacum*) and spotted salamander (*Ambystoma maculatum*), are locally common at present but could disappear from the area if their breeding ponds should be lost to development or modification of the water table. These same transient pools utilized by these amphibians also support a number of specialized invertebrates (fairy shrimp, triclad planarians, etc.) that are restricted to these habitats. One other species, the green treefrog (Hyla cinerea), is restricted to brackish water and occurs within the Western Branch Watershed only in the extensive marsh at the mouth of Western Branch.

A number of the species present can be observed throughout their seasonal activity period. Others, however, can be found only during relatively short periods when they gather at breeding places. With the exception of the two resident toad species (Bufo), most local amphibians are nocturnal and are only found active at night or collected during the day under rocks, logs, tree bark and in other places of concealment. Night collecting can be particularly profitable during spring and summer rains when many species are found moving about on roadways. Frogs, in breeding congregations, are easily identified by their calls and may be found simply by driving around on rainy evenings and noting the location of breeding choruses. Frequently, more than one species will occupy the same breeding site.

Amphibians, especially salamanders, are generally sensitive to water pollution and thus serve as good indicators of water quality. They also play an important role in the food chain and are preyed on by numerous aquatic and wetland vertebrates. An excellent guide to the identification of all local species is provided by Conant (1975). Harris (1975) has published a detailed study of the distribution of the Maryland species.

The amphibians found during this survey are listed below with a brief description of their major habitats and a letter code indicating their relative abundance within this watershed (abundant=A, common=C, uncommon=U, rare=R).

Salamanders

Spotted salamander (Ambystoma maculatum)- Woodlands, R
Marbled salamander (Ambystoma opacum)- Woodlands, R
Dusky salamander (Desmognathus fuscus)- Springs and spring runs, R
Two-lined salamander (Eurycea bislineata)- Small streams, R
Four-toed salamander (Hemidactylium scutatum)- Woods and bogs, R
Newt (Notophalmus viridescens)- Ponds, C
Red-backed salamander (Plethodon cinereus)- Woods, C
Mud salamander (Pseudotriton montanus)- Springs and seeps, R
Red salamander (Pseudotriton ruber)- Springs, seeps and streams, R

Frogs and Toads

Cricket frog (Acris crepitans)- Ponds, C
American toad (Bufo americanus)- All habitats, U
Fowler's toad (Bufo woodhousei)- All habitats, C

Green treefrog (*Hyla cinerea*)- Tidal wetlands, C
Spring peeper (*Hyla crucifer*)- Woodland ponds, C
Grey treefrog (*Hyla chrysosceles*)- Woodlands, R
Chorus frog (*Pseudacris triseriata*- Woods and field ponds, U
Bull frog (*Rana catesbeina*)- Ponds and sluggish streams, U
Green frog (*Rana clamitans*)- Ponds and sluggish streams, A
Pickerel frog (*Rana palustris*)- Ponds and sluggish streams- R
Leopard frog (*Rana utricularia*)- Ponds and sluggish streams, C
Wood frog (*Rana sylvatica*)- Woodlands, R
Spadefoot toad (*Scaphiopus holbrooki*)- Woodlands, R

Reptiles

Of the thirty species of reptiles known to occur within the Western Branch Watershed, only the Box turtle (*Terrepene carolina*) and the Painted turtle (*Chrysemys picta*) are frequently encountered. Box turtles are common in all terrestrial habitats and are often observed wandering across roadways. The Painted turtle is an aquatic species that is abundant in ponds and slow moving streams, where large numbers of individuals can be seen basking on logs or other objects. The remaining reptiles are uncommon or secretive although Black rat snakes (*Elaphe obsoleta*), Garter snakes (*Thamnophis sirtalis*) and several species of lizards sometimes occur in or around occupied house sites. Generally, these are unwelcome visitors even though the rat snake is an efficient predator on troublesome rodents.

One local species of snake, the Copperhead (*Agkistrodon mokeson*) is venomous. This colorful snake is not uncommon and specimens were observed at several locations scattered throughout the watershed. Although venomous, the Copperhead is not agressive and is easily identified by its distinctive color pattern. Since most recorded bites result from attempts to catch or handle these snakes, the best protection is simply to leave them alone if possible.

A review of the distribution of the Maryland reptile fauna has been given by Harris (1975). This publication provides dot maps depicting the distribution of all species and includes a useful bibliography. It is interesting to note that records for many common species are lacking on his maps for the Western Branch drainage, indicating a lack of collecting effort in this region during past years. Conant (1975) gives much additional information on the distribution and ecology of these species and includes an excellent guide to their identification.

The local terrestrial species of reptiles are frequently abundant in such disturbed areas as power line rights-of-way, old house sites, trash piles and dumps. The aquatic species are relatively resistant to moderate degrees of water pollution. Considering this tolerance of human presence and reasonable levels of habitat disturbance, it is not expected that the future development of this watershed will adversly affect the local populations unless the proposed land use is significantly changed.

The species found during this survey or reported from within this area by Harris (1975) are listed below with a brief description of their major habitats and a letter code indicating their relative abundance (abundant=A, common=C, uncommon=U, rare=R).

Turtles

Snapping turtle (*Chelydra serpentina*)- Ponds and streams, C
Painted turtle (*Chrysemys picta*)- Ponds and streams, A
Red-bellied turtle (*Chrysemys rubriventris*)- Ponds and streams, R
Spotted turtle (*Clemmys guttata*)- Swamps and ponds, C
Mud turtle (*Kinosternon subrubrum*)- Ponds, U
Diamond back terrapin (*Malaclemys terrapin*)- Estuary, U
Musk turtle (*Sternotherus odoratus*)- Ponds and streams, U
Box turtle (*Terrapene carolina*)- All terrestrial areas, C

Lizards

Racerunner (*Cnemidophorus sexlineatus*)- Open fields, R
Five-lined skink (*Eumeces fasciatus*)- All terrestrial areas, U
Broad-headed skink (*Eumeces laticeps*)- Edges of woodlands, R
Fence lizard (*Sceloporus undulatus*)- Edges of woodlands, U

Snakes

Copperhead (*Agkistrodon mokeson*)- All terrestrial areas, C
Worm snake (*Carphophis amoenus*)- All terrestrial areas, U
Black racer (*Coluber constrictor*)- All terrestrial areas, C
Ringneck snake (*Diadophis punctatus*)- All terrestrial areas, U
Corn snake (*Elaphe guttata*)- All terrestrial areas, R
Black rat snake (*Elaphe obsoleta*)- All terrestrial areas, C
Hognose snake (*Heterodon platyrhinos*)- Fields, R
Mole snake (*Lampropeltis calligaster*)- Fields, R
Kingsnake (*Lampropeltis getulus*)- All terrestrial areas, U
Milk snake (*Lampropeltis triangulum*)- All terrestrial areas, R
Queen snake (*Natrix septemvittata*)- Streams, R
Water snake (*Natrix sipedon*)- All aquatic habitats, C
Green snake (*Ophedrys aestivus*)- Fields, U
Brown snake (*Storeria dekayi*)- All terrestrial habitats, U
Red-bellied snake (*Storeria occipitomaculata*)- Fields, R
Ribbon snake (*Thamnophis sauritus*)- Ponds and swamps, U
Garter snake (*Thamnophis sirtalis*)- All terrestrial areas, A
Earth snake (*Virginia valeriae*)- All terrestrial areas, U

Birds

An intensive survey program was undertaken to observe and record bird species within the Western Branch Watershed. Areas were selected throughout this area to include all major habitat types. These areas were then visited repeatedly, during all seasons of the year, and birds were observed with the aid of binoculars. In addition to our own observations, members of the Maryland Ornithological Society were contacted and provided much useful information.

A very good treatment of the Maryland avifauna has been given by Stewart and Robbins (1958) but is unfortunately out of print. This text was very useful in the development of this list. It not only enumerates the known local species, but presents much information on their dates of occurrence, breeding ranges, nesting periods and migration routes. This information has been updated in abbreviated form by Robbins and Van Velzen (1968). Anyone interested in additional information concerning the distribution, habitat preferences or dates of occupation of species inhabiting this watershed should consult Robbins and Van Velzen.

In the list given below, scientific names are not given since accepted common names are available for all local forms. The names used here follow Robbins, Bruun and Zim (1966), an excellent guide to bird identification. Those species that have been observed breeding within the watershed by us, or indicated to breed in this area by the previously cited publications, are indicated with an "N". Also indicated is the period of their most likely occurrence (year round resident=R, winter=W, summer=S, spring and fall migrant=M).

All of these species have been sighted within the study area by us or other competent observers. A review of the distributions given by Robbins and Van Velzen (1968), however, indicates that a number of additional species can be expected.

Pied-billed grebe	R
Great blue heron	RN
Green heron	SN
Little blue heron	SN
Common egret	S
Snowy egret	S
Black-crowned night heron	RN
Yellow-crowned night heron	SN
Least bittern	SN
American bittern	RN
Canada goose	W
Mallard duck	RN
Black duck	RN
Wood duck	RN
Ruddy duck	W
Turkey vulture	RN
Black vulture	RN
Sharp-shin hawk	R
Cooper's hawk	RN
Red-tailed hawk	RN
Red-shouldered hawk	RN
Broad-winged hawk	SN
Rough-legged hawk	W
Bald eagle	M
Osprey	SN
Sparrow hawk	RN

Bobwhite	RN
Ring-necked pheasant	RN
King rail	RN
Virginia rail	RN
Sora	SN
Common gallinule	SN
American coot	RN
Killdeer	RN
American woodcock	RN
Common snipe	W
Spotted sandpiper	SN
Solitary sandpiper	S
Herring gull	R
Ring-billed gull	R
Laughing gull	S
Mourning dove	RN
Rock dove	RN
Yellow-billed cuckoo	SN
Black-billed cuckoo	SN
Barn owl	RN
Screech owl	RN
Great horned owl	RN
Barred owl	RN
Saw-whet owl	R
Whip-poor-will	SN
Common nighthawk	SN
Chimney swift	SN
Ruby-throated hummingbird	SN
Belted kingfisher	RN
Yellow-shafted flicker	RN
Pileated woodpecker	RN
Red-bellied woodpecker	RN
Red-headed woodpecker	RN
Yellow-bellied sapsucker	RN
Hairy woodpecker	RN
Downy woodpecker	RN
Eastern kingbird	SN
Great crested flycatcher	SN
Phoebe	RN
Acadian flycatcher	S
Wood pewee	SN
Olive-sided flycatcher	S
Horned lark	W
Tree swallow	SN
Rough-winged swallow	SN
Barn swallow	SN
Purple martin	SN
Blue jay	RN
Common crow	RN
Carolina chickadee	RN
Tufted titmouse	RN
White-breasted nuthatch	RN
Red-breasted nuthatch	W
Brown creeper	RN
House wren	SN
Winter wren	W
Carolina wren	RN
Mockingbird	RN
Catbird	RN
Brown thrasher	RN
Robin Wood thrush	RN
Wood thrush	SN
Hermit thrush	M
Swainson's thrush	M
Gray-cheeked thrush	M
Veery	M
Eastern bluebird	RN
Blue-gray gnatcatcher	RN
Golden-crowned kinglet	WM
Ruby-crowned kinglet	WM
Cedar waxwing	M
European starling	RN
White-eyed vireo	SN
Red-eyed vireo	SN
Black-and-white warbler	M
Prothonotary warbler	SN
Worm-eating warbler	M
Golden-winged warbler	M
Blue-winged warbler	M
Tennessee warbler	M
Parula warbler	S
Yellow warbler	SN
Magnolia warbler	M
Cape May warbler	M
Black-throated blue warbler	M
Yellow-rumped warbler	M
Black-throated green warbler	M
Blackburnian warbler	M
Yellow-throated warbler	M
Chestnut-sided warbler	M
Bay-breasted warbler	M
Blackpoll warbler	M
Pine warbler	M
Prairie warbler	SM
Ovenbird	SM
Louisianna waterthrush	M
Kentucky warbler	S
Yellowthroat	SN
Yellow-breasted chat	SN
Hooded warbler	SN
Canada warbler	M
American redstart	SN

House sparrow	RN	Purple finch	M
Bobolink	M	House finch	M
Eastern meadowlark	RN	American goldfinch	RN
Red-winged blackbird	RN	Rufous-sided towhee	SM
Orchard oriole	SM	Savannah sparrow	M
Northern oriole	SN	Grasshopper sparrow	M
Rusty blackbird	M	Northern junco	WM
Common grackle	SN	Chipping sparrow	SN
Brown-headed cowbird	SN	Field sparrow	SN
Scarlet tanager	SN	White-crowned sparrow	M
Cardinal	RN	White-throated sparrow	WM
Rose-breasted grosbeak	M	Fox sparrow	M
Indigo bunting	SN	Swamp sparrow	M
Evening grosbeak	W	Song sparrow	WM

Mammals

An excellent treatment of the Maryland mammal fauna has been provided by Paradiso (1969). This text includes identification keys, descriptions, information on ecology and behavior, a good bibliography and a detailed review of the state-wide distribution of all species known to occur in Maryland. Paradiso's book was found to be an invaluable resource during the preparation of this document, and should be consulted by anyone seeking additional information concerning the mammals of the Western Branch Watershed.

The habitat requirements of most of the local species are fairly general and include disturbed areas. None appear to require mature deciduous woodland although deer generally need larger undeveloped tracks with some forestland for day time concealment and cover during winter. Most of the uncommon or little known species have been reported from field or cut over areas. Several of these species seem to be quite rare and have not been observed in recent years. Even though their habitat types are abundant and in no danger of disappearance, it would be useful to determine their actual status within the state. One active beaver lodge was found during this survey. This large amphibious species has recently been reintroduced into Maryland and it should be afforded protection from disturbance (i.e. drainage, hunting) until it becomes more abundant.

Several local species of mammals (deer, rabbits, grey squirrels) are hunted and provide an important recreational resource. Others (muskrat, otter, weasel) provide skins of commercial importance, although they are not abundant enough within the watershed to offer significant economic benefit.

The mammals identified during this survey or reported from within the Western Branch Watershed by Paradiso (1969) are listed below with a brief description of their major habitats and a letter code indicating their relative abundance (abundant=A, common=C, uncommon=U, rare=R). Those species that are known from this area only by older records reported by Paradiso are noted with an asterisk (*).

Opossum (Didelphis marsupialis)- All habitats, C
Masked shrew (Sorex cinereus)- Deciduous woods, U
*Southeastern shrew (Sorex longirostris)- Fields, R
Short-tailed shrew (Blarina brevicauda)- All habitats, C
Least shrew (Cryptotis parva)- Fields, R
Eastern Mole (Scalopus aquaticus)- Sandy soil in all habitats, U
Star-nosed mole (Condylura cristata)- Woods, meadows, swamps, R
Silver-haired bat (Lasionycteris noctivagans)- All habitats, R
Big brown bat (Eptesicus fuscus)- All habitats, U
Red bat (Lasiurus borealis)- All habitats, U
Eastern cottontail (Sylvilagus floridanus)- All habitats, A
Eastern chipmunk (Tamias striatus)- Wooded areas, U
Woodchuck (Marmota monax)- Pastures, fields cut over areas, C
Grey squirrel (Sciurus carolinensis)- Wooded areas, C
Red squirrel (Tamiasciurus hudsonicus)- Wooded areas, R
Flying squirrel (Glaucomys volans)- Wooded areas, C
Beaver (Castor canadensis)- Ponds and wetlands, R
White-footed mouse (Peromyscus leucopus)- All habitats, A
Meadow vole (Microtis pennsylvanicus)- Non-wooded habitats, A
*Pine vole (Pitymys pinetorum)- Fields, R
Muskrat (Ondatra zibethicus)- Ponds, streams, wetlands, C
Norway rat (Rattus norvegicus)- Developed areas, U
House mouse (Mus musculus)- All habitats, U
Red fox (Vulpes vulpes)- All habitats, U
*Grey fox (Urocyon cinereoargenteus)- All habitats, R
*Bobcat (Lynx rufus)- Wooded areas, R
Raccoon (Procyon lotor)- All habitats, C
Long-tailed weasel (Mustela frenata)- All habitats, R
Striped skunk (Mephitis mephitis)- All habitats, C
River otter (Lutra canadensis)- Ponds, streams, wetlands, R
White-tailed deer (Odocoileus virginianus)- Wooded and cut over areas, U

In addition to those species on the previous list, the following mammals are expected to occur within this watershed. Paradiso (1960) gives records for each from adjacent areas of Prince Georges County and includes Western Branch within their expected range.

Little brown bat (Myotis lucifugus)
Keen's myotis (Myotis keenii)

Eastern pipistrelle (*Pipistrellus subflavus*)
Hoary bat (*Lasiurus cinereus*)
Evening bat (*Nycticeius humeralis*)
Pigmy shrew (*Microserex hoyi*)
Fox squirrel (*Sciurus niger vulpinus*)
Marsh rice rat (*Oryzomys palustris*)
Eastern harvest mouse (*Reithrodontomys humulis*)
Deer mouse (*Peromyscus maniculatus bairdii*)
Southern bog lemming (*Synaptomys cooperi stonei*)
Meadow jumping mouse (*Zapus hudsonius*)
Mink (*Mustela vison*)

Endangered Species

Thirty-five species or subspecies of animals occurring in Maryland are currently protected by either the State of Maryland or the federal government. Of these species, two have been reported from within the Western Branch Watershed. They are briefly discussed below.

Bobcat (*Lynx rufus*)- According to Paradiso (1969), the bobcat was formerly found throughout Maryland but is now "confined primarily to the Allegheny Mountain and Ridge and Valley Sections. It has been entirely exterminated in the Eastern Shore Section and is only rarely encountered in the Western Shore and Piedmont Sections." Paradiso gives records for this species from several localities adjacent to the watershed and notes an old record from within the watershed near Upper Marlboro. This record was reported by Bailey in 1923 and the species has apparently not been observed in this area since. However, in the absence of a more extensive survey, it can not be definitively said that the bobcat does not still occur in small numbers in heavily wooded or brushy areas of bottomland woods or swamps.

The best measures that could be taken to support the continued existence of this species within the drainage of Western Branch, if it does still occur there, or to provide suitable conditions for recolonization if it should reclaim this portion of its former range, would be the preservation of extensive, heavily wooded or brushy areas, particularly along flood plains or swamps.

Southern bald eagle (*Haliaeetus l. leucocephalus*)- We have several records of the bald eagle within the watershed. These records represent transient individuals and no reports of recent nesting seem to be available. This species appears to be slowly recovering from its severe population decline of the 60's and 70's and, as its numbers increase, it may become a more regular visitor to this area and may even nest. As with the bobcat, the preservation of suitable habitat for this species is of critical importance if the Western Branch Watershed is ever to support resident individuals. In addition to undisturbed wooded areas, maintaining good water quality is also vital. Of particular importance is control of persistant toxic compounds that can be concentrated through the aquatic food chain until they reach nesting eagles.

Literature Cited

Brown, R. G., and M. L. Brown. 1972. Woody Plants of Maryland. Port City Press, Baltimore. 347 pages.

Christensen, C. M. 1965. Common Fleshy Fungi. Burgess Publishing Co., Minneapolis. 237 pages.

Conant, R. 1975. A Field Guide to Reptiles and Amphibians of Eastern and Central North America, second edition. Houghton Mifflin Co., Boston. 429 pages.

Conard, H. S., and P. L. Redfearn, Jr. 1979. How to Know the Bryophytes, second edition. Wm. C. Brown Co., Dubuque. 302 pages.

Davis, R. M. 1974. Kew to the Freshwater Fishes of Maryland. Univ. of Maryland Natural Resources Institute, Lavale, Md., Educational Series 101. 48 pages.

Eddy, S. 1969. How to Know the Freshwater Fishes. Wm. C. Brown Co., Dubuque. 286 pages.

Hale, M. E. 1979. How to Know the Lichens, second edition. Wm. C. Brown Co., Dubuque. 246 pages.

Harris, H. S. 1975. Distributional Survey (Amphibia/Reptilia): Maryland and the District of Columbia. Bulletin Maryland Herpetological Society 11(3): 73-167.

Hawksworth, D. L., and F. Rose. 1976. Lichens as Pullution Indicators. London. 643 pages.

Hotchkiss, N., and R. E. Stewart. 1979. Vegetation and Vertebrates of the Patuxent Wildlife Research Center;

Outline of Ecology and Annotated Lists. U. S. Dept. of Interior, Fish and Wildlife Service, Patuxent Wildlife Research Center, Laurel, Maryland. 120 pages.

Lee, D. S., A. Norden, C. Gilbert and R. Franz. 1976. A List of the Freshwater Fishes of Maryland and Delaware. Chesapeake Science 17(3): 205-211.

Metzgar, R. G. 1973. Wetlands in Maryland. Maryland Dept. of State Planning, Pub. No. 157. Baltimore.

Miller, O. K., Jr. 1972. Mushrooms of North America. E. P Dutton & Co., Inc., New York. 360 pages.

Paradiso, J. L. 1969. Mammals of Maryland. U. S. Dept. of Interior, Bureau of Sport Fisheries and Wildlife, North American Fauna No. 66. 193 pages.

Radford, A. E., H. E. Ahles and C. R. Bell. 1968. Manual of the Vascular Flora of the Carolinas. Univ. of North Carolina Press, Chapel Hill. 1183 pages.

Reed, C. F. 1953. The Ferns and Fern-Allies of Maryland and Delaware including the District of Columbia. Published by Author, Reed Herbarium, Baltimore. 286 pages.

Robbins, C. S., and W. T. Van Velzen. 1968. Field List of the Birds of Maryland. Maryland Ornithological Society, Maryland Avifauna No. 2. 43 pages.

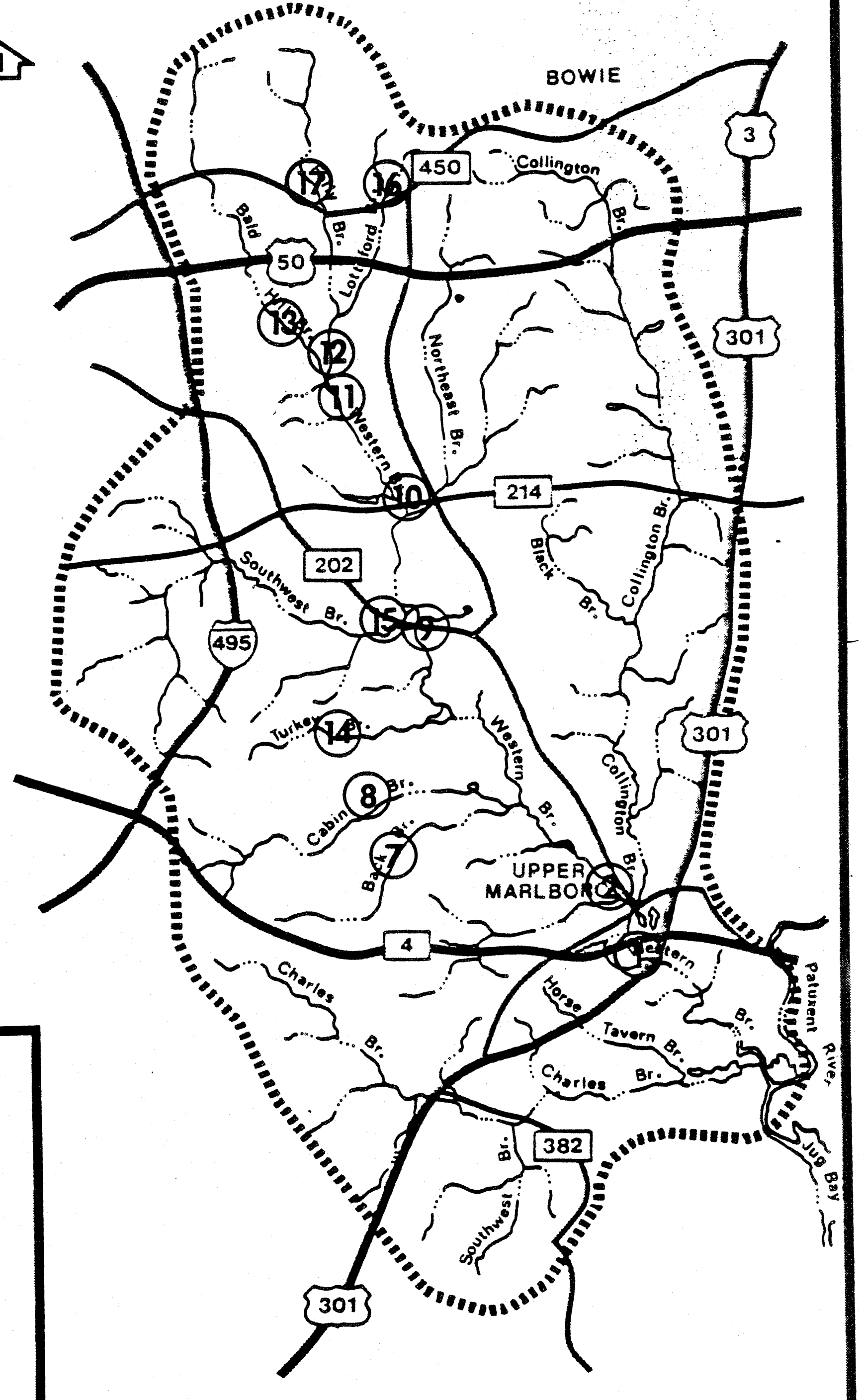
Robbins, C. S., B. Bruun and H. S. Zim. 1966. Birds of North America. Golden Press, New York. 340 pages.

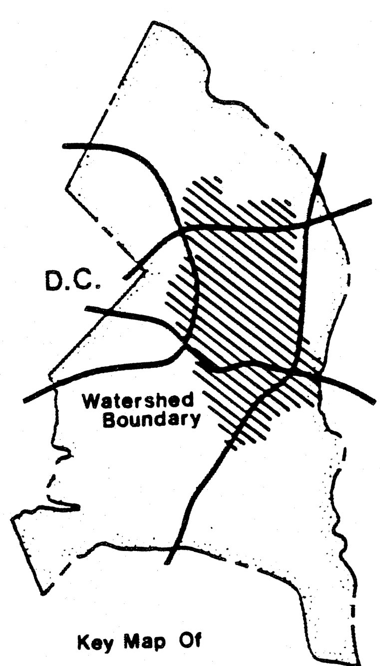
Shaw, S. P., and C. G. Fredine. 1956. Wetlands of the United States. U. S. Dept. of Interior, U. S. Fish and Wildlife Service, Circular 39. 67 pages.

Skorepa, A., and D. Windler. A Proposal to the Power Plant Siting Program for Renewal of Contract P31-77-04. Maryland Department of Natural Resources, Power Plant Siting Program. 25 pages.

Stewart, R. E., and C. S. Robbins. 1958. Birds of Maryland and the District of Columbia. U. S. Dept. of Interior, Bureau of Sport Fisheries and Wildlife, North American Fauna No. 62. 399 pages.

Windler, D. 1979. The Use of Lichens as Indicator Organisms for Decting Changes in Various Air Pollutants. Completion Report to the Maryland Department of Natural Resources, Power Plant Siting Program (Contract P31-77-04).





WESTERN BRANCH WATERSHED

WATER QUALITY SAMPLING STATIONS

FIGURE 2

future land use condition was determined from the various adopted and approved comprehensive rezoning maps of the area: Where a zoning map was not available, guidance was sought from the Area Master Plan.

Routed discharge flow values to specific locations on the streams for floods of the specified recurrence intervals are shown in Appendix A.

6.2 Validation of Discharge Values

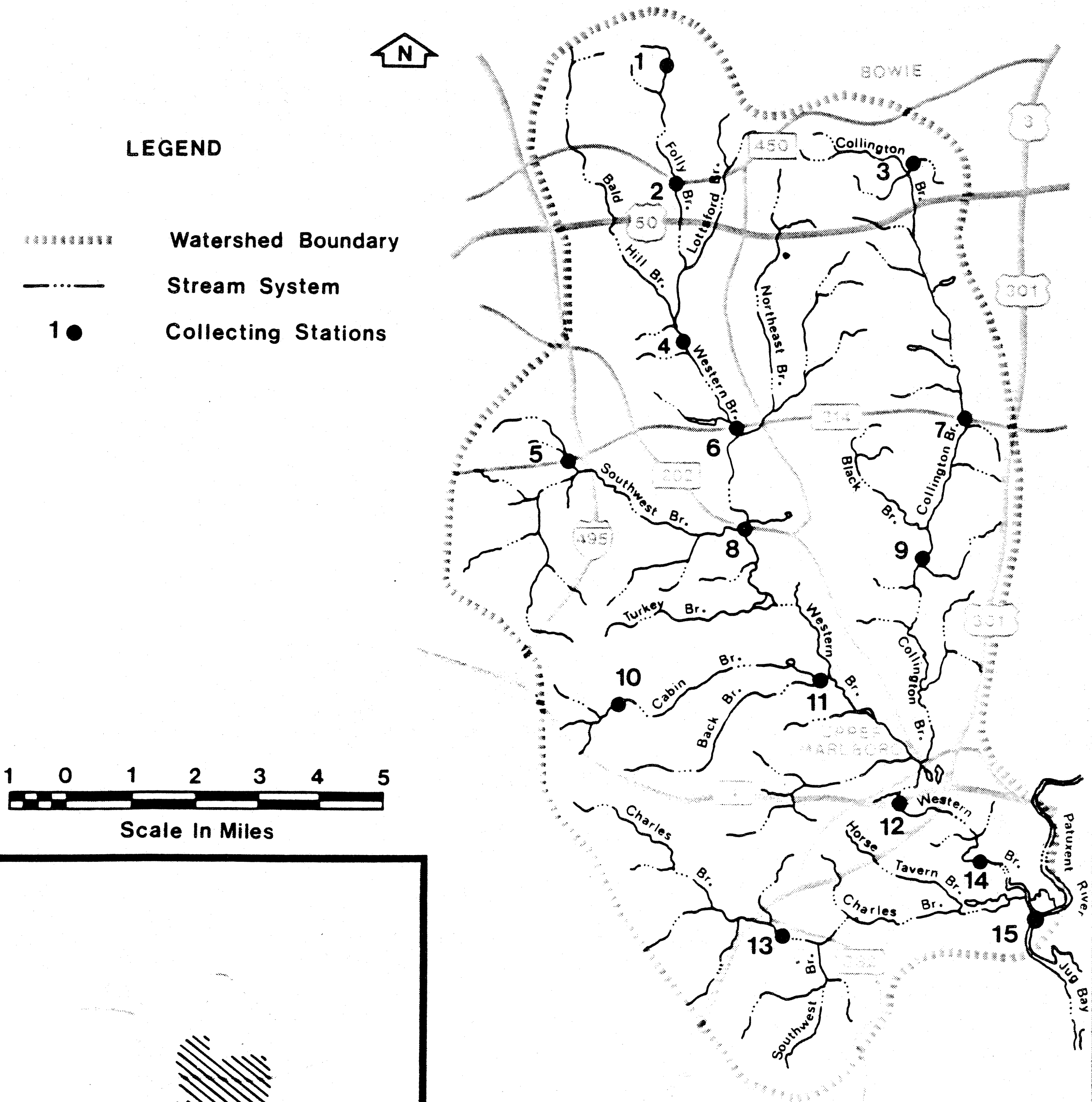
The peak discharge values obtained for present land use conditions using the TR-20 computer program were compared with values developed by other generally acceptable hydrologic techniques. These techniques include: (a) Statistical analysis of stream gauge data from station records on Western Branch near Largo and on Northeast Branch of Anacostia River near Riverdale, (b) transposition of flow data from other gauged watersheds with physical, hydrologic and meteorological characteristics similar to Western Branch, (c) drainage area - discharge-frequency relationships from similar watersheds in the region and (d) regression equations.

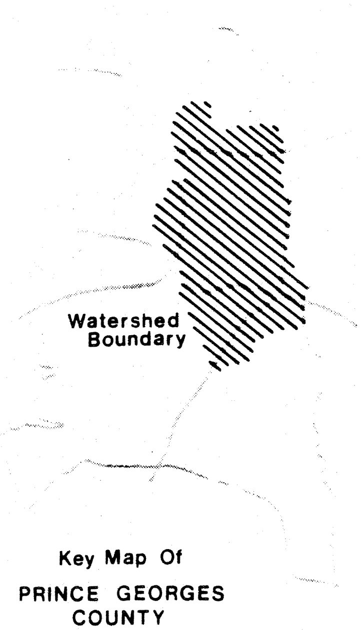
Statistical Analysis:

The U.S. Geological Survey maintained a stream gauging station on Western Branch approximately 200 feet upstream of Largo Road from 1949 to 1974. The gauge had a drainage area of 30.2 square miles. This gauging station was discontinued due to the unreliability of the stage-discharge relationship obtained from it. From 1949 to 1974, Western Branch Watershed underwent a transformation from a rural to a suburban area, resulting in increased impervious land cover, storm drain sewerage, and greater storm runoff for a given amount of precipitation. The changed land use and resultant runoff increases created a measure of non-homogeneity within the population of runoff values at the Largo Road gauging station. To homogenize the population, the 25 years of record were segmented into 3 horizons of similar development activity in the region - 1949 to 1960, 1961 to 1968 and 1969 to 1974. The effect of development to year 1979 on each horizon's flow was assessed, thereby reducing all flow values to a common developmental period base. The homogenized flows were distributed using a Log-Pearson Type III curve (Reference 7). A comparison of TR-20 values and those obtained using the Log-Pearson Type III distribution is made in Table 4.

1.3 Purpose of Study

The purpose of this study is to identify through hydrologic and other analyses, the existing and future watershed problems relating to flooding, erosion, sedimentation, water quality, wetlands and other environmental features.





WESTERN BRANCH WATERSHED

AQUATIC COLLECTING STATIONS

FIGURE 5

Figure 7

PARKS AND HISTORIC SITES
WESTERN BRANCH WATERSHED