COMPREHENSIVE MANAGEMENT PLAN
WESTERN BRANCH
PRINCE GEORGE'S COUNTY, MARYLAND

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Water is the most essential element in life. It is abundant and plentiful but most often, from the human perspective, misplaced. When our streams receive too much of it, they sicken, spill over and flood. When too little is received, they quicken and soon die. Oh water!, how I love thee.

1981 quotation from "NATS", M-NCPPC

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1.0 SUMMARY AND RECOMMENDATIONS

1.1 Summary

The objective of this management plan is to minimize the magnitude and frequency of flooding and related problems in the watershed. In formulating this objective, several functional constraints were imposed. The most significant of these were: (a) the mitigation of a flooding problem in a section of the watershed should not cause an exacerbated condition somewhere else; (b) the solution or plan should have a measure of relative constancy and permanency; and (c) the solution should be feasible and cost-effective.

Several solutions or alternatives were carefully analyzed in terms of the objective function and the plan or solution with the greatest measure of optimality, is an amalgam of mini-solutions. It consists of structural and non-structural measures and calls for a greater restriction or prohibition of those land use activities that either aggravate the existing flood hazard or expose additional human lives and property to flood hazard. This should be done by reviewing existing local ordinances for possible fortification. It also calls for the notification of owners of flood prone structures within the watershed and to inform them of the availability of federally subsidized flood insurance.

1.2 Recommendations

Flooding:

The recommended Management Plan for Western Branch watershed, (including Collington), consists of the following elements:

- Rezoning the Folly Branch subwatershed upstream of the Conrail Railroad crossing to categories of lower density or intensity.
- Increasing the size of the culvert opening under the Conrail Railroad crossing over Folly Branch from 72 square feet to approximately 144 square feet.
- Construction of a 300 acre-foot dry detention basin upstream of the Lincoln Subdivision on Folly Branch.
- Removal of the Abandoned Route 704 Embankment on Folly Branch.
- Construction of a 90 acre-foot dry detention basin on Bald Hill Branch approximately 1,100 feet upstream of Good Luck Road crossing.
- Construction of a wet multi-purpose pond on Western Branch main stem with a storage capacity of 440 acre-foot in Walker Mill Park on Southwest Branch.
- Construction of a 400 acre-foot dry detention basin approximately 4,500 feet upstream of Harry S. Truman Drive crossing on Southwest Branch.
- Construction of a 3,000 acre-foot dry detention basin on Collington Branch downstream of Leeland Road.
- Construction of a wet multi-purpose pond in the vicinity of Watkins Regional Park. This pond would have a surface area of approximately 200 acres with a flood storage capacity of 2,553 acre-feet.
- Construction of a levee approximately 6 feet high and 530 feet long on the south side of Old Marlboro Pike between Brown Station Road and the Marlboro Country Club driveway, along Federal Spring Branch.
- Construction of a levee system along the Western Branch main stem between Route 301 southbound and Conrail. Total length of this system would be approximately 1,000 feet with an average height of 4 feet.
- Upgrading and raising the height of the levee - water proof fence system on the west bank of the Western Branch main stem, extending from Water Street to a location approximately 1,800 feet upstream.

- o Acquisition of residential structures located within the flood limits of Cabin Branch, Bald Hill Branch, Federal Spring and the main stem of Western Branch.

- o Notification of owners of flood prone structures of the availability of federally subsidized flood insurance.

- o Greatly restricting or prohibiting land use activities that would aggravate existing flood hazard or precipitate new ones.

- o Individual flood proofing of several residential structures, as a site specific solution in areas of the watershed.

- o A request to Maryland State Highway Administration to correct the ponding condition around the intersection of Route 301 and Chrysler Drive.

Erosion and Sedimentation:

Erosion

- o The County in conjunction with the State Highway Administration should initiate an annual cleanup and clean out program for culverts and bridge waterways throughout the County.

- o To arrest the erosion of stream bank areas identified in the study, stream channel composition changes through the use of gabions, rip rap, lattice blocks or vegetation should be undertaken.

- o Immediate corrective action should be taken at the Conrail crossing on Folly Branch where a retaining wall for a sewer line back fill is in danger of failure.

- o Immediate corrective action should be taken to prevent the complete failure of the concrete channel downstream of the Conrail crossing on Bald Hill Branch.

- o To prevent the eventual vanishment of the concrete channel in the vicinity of Hampton Mall, immediate corrective action should be taken.

- o The State Highway Administration should be notified of the impending collapse of the right embankment of the entrance ramp onto Route 50 from Route 704.

Sedimentation

- o Existing regulations, ordinances and codes directed toward sediment control should be vigorously enforced.

- o A survey of agricultural enterprises should be conducted to identify poorly managed sites. Once identified, remedial measures should be taken.

- o Clear cutting of woodlands and trees within the 100 year flood plain should be under a County agency control.

- o Features preventing the introduction of runoff from impervious surfaces directly into receiving waters should be incorporated into storm water management plans.

Water Quality:

- o The Health Department should be requested to initiate a stream program which includes analysis for fecal streptococcus (FS) as well as fecial coliform (FC) to assist in establishing a distinction between human and animal pollution in water.

- o Sensitive site planning which retains natural drainageways, minimizes impervious surfaces, retains vegetative cover, maximizes the distance between development activities and drainageways and maximizes the soil's infiltration capacity, should be encouraged.

- o The use of "Best Management Practices" which maximize water quality benefits while achieving water quantity goals, should be encouraged.

- o Measures such as natural drainage, contour landscaping, dutch drains, porous pavements, grass lined swales and infiltration pits and trenches, where applicable, should be encouraged.

Conservation Areas:

- o A survey should be initiated to determine if anadromous fishes are prevented from migrating up Western Branch by the riffle at Water Street or by 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 larve 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 the Department of Natural Resources.

2.0 INTRODUCTION

This report contains information related to the analyses of feasible solutions to problems identified within the Western Branch watershed. Other pertinent information are on file in the Environmental Planning Division of the Maryland-National Capital Park and Planning Commission, County Administration Building, Upper Marlboro, Maryland.

2.1 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 stormwater 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 with storm water management responsibilities. This Task Force is 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 was: 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 watershed management Plans to address the issues of flooding, water quality, sedimentation, and erosion within the major watersheds in the County. The Technical Group was formed in December 1977, under the general guidance of the Storm Water Management Technical Committee.

3.0 STUDY GOALS AND OBJECTIVES

The goals and objectives of this study are based on County goals as stated in the Stormwater Management Task Force Report (Reference 1) and summarized here.

3.1 Goal

To properly manage flood and stormwater to prevent loss of life and minimize property damage while maintaining the flood plain in its natural state and maintaining an aesthetic environment and surface water quality.

3.2 Objectives

To develop a comprehensive stormwater mangement plan for the Western Branch Watershed by:

. Identifying through hydrologic and other analysis, the existing and future watershed problems relating to flooding, erosion, sedimentation, water quality, wet lands and other environmental features.

. Analyzing various alternative control and management options and developing an optimum plan for the watershed.

3.3 Study 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, 1980, form the basis for this work. Funding for the program was provided from WSSC Storm Drain Maintenance Accounts, and transferred to M-NCPPC and the County through the aforementioned contracts.

4.0 WATERSHED DESCRIPTION

4.1 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 the management plan study is the entire Western Branch watershed upstream of its confluence with Charles Branch. At this confluence point, Western Branch has a watershed area of 92 square miles. 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.

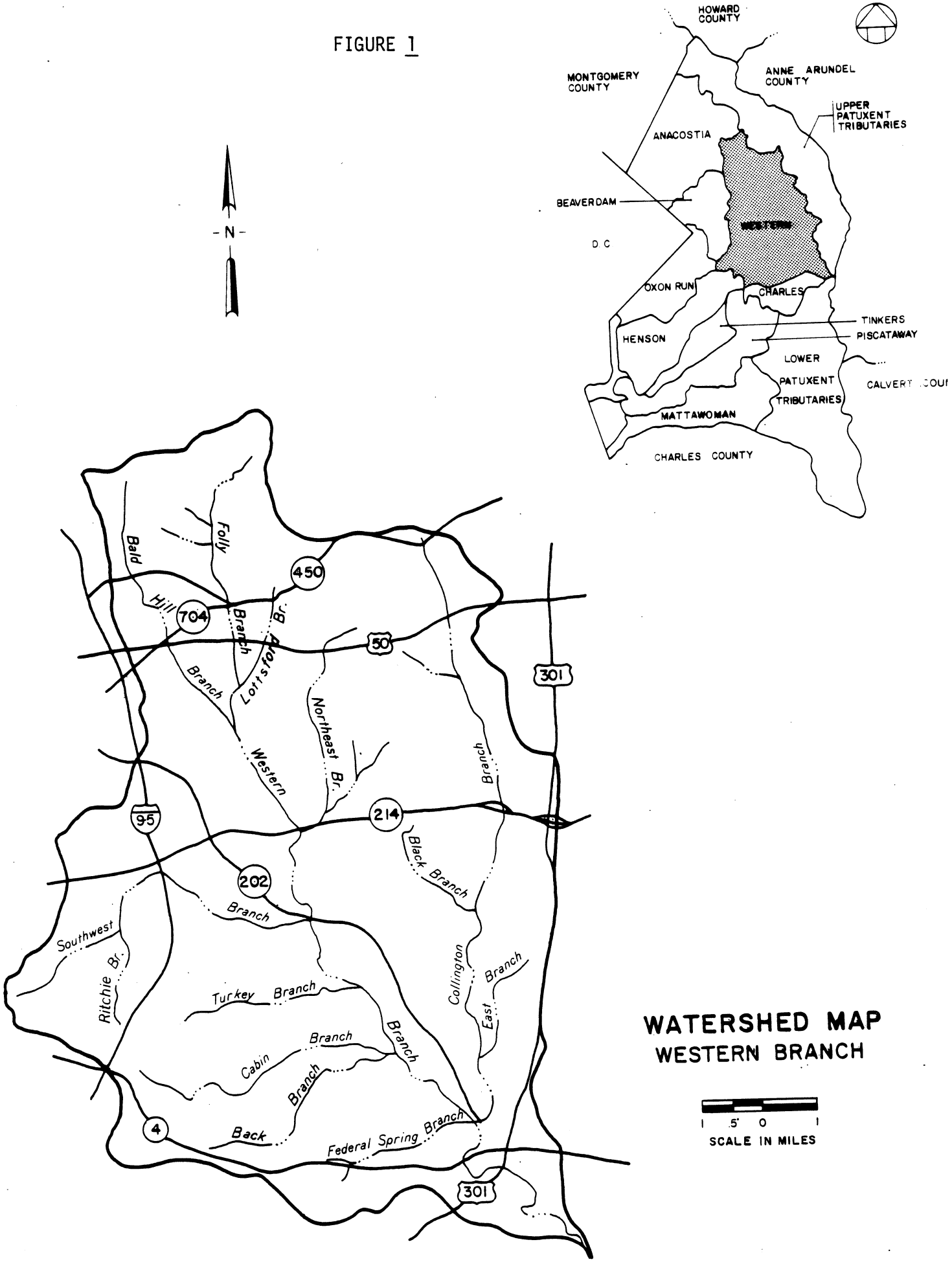
Folly Branch, with a drainage area of 6.2 square miles, rises northeast of the intersection of Lanham-Severn and Greenbelt Roads. For most of its 5.3 miles length this branch has an extremely flat gradient with a wide, swampy and ill-defined channel. However, between Lanham-Severn and Glenn Dale Roads, 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 south of Route 214. It has a drainage area of approximately 8.8 square miles, and an average slope of 17.5 feet/mile.

FIGURE 1



WATERSHED MAP
WESTERN BRANCH

- 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.

- Collington Branch which flows into Western Branch from the east at Main Street has a drainage area of 22.5 square miles, and an average slope of 10.6 feet/mile. Collington Branch originates in the Bowie area, north of Route 450 .

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).

4.2 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 por-

tion 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.

4.3 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
Collington Branch	10
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

*Excluding Collington Branch Watershed area.

5.0 PROBLEM DEFINITION

A technical data base report prepared previously (Reference 4) identified areas within the watershed that are presently susceptible to flooding, erosion, sedimentation and other environmental problems. An area is identified as susceptible to flooding if it is within the 100-year flood limits. Additional areas that would become prone to these problems as future land use plans are implemented, were also delineated. The problems and where they occur in the watershed are summarized in this section, by watercourse, and are tabulated in Tables 3 and 4.

5.1 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.

TABLE 3

FLOOD PRONE STRUCTURES
EXISTING LAND USE
(WITH NO MANAGEMENT PLAN)

TYPE OF STRUCTURE/ STREAM COURSE	RESIDENTIAL	GARAGES/ SHEDS	COMMERCIAL	SCHOOLS	RECREATIONAL
FOLLY	10	9	4	1	-
LOTTSFORD	-	3	-	-	-
BALD HILL	17	14	-	-	-
NORTHEAST	-	7	1	-	-
SOUTHWEST	6	16	10	-	2
TURKEY	-	1	-	-	-
CABIN	1	3	-	-	-
BACK	-	2	-	-	-
FEDERAL SPRING	5	6	2	-	-
COLLINGTON	8	2	-	-	-
WESTERN (Main Stem)	19	28	62	-	-
T O T A L	66	91	79	1	2

TABLE 4

FLOOD PRONE STRUCTURES
FUTURE LAND USE
(WITH NO MANAGEMENT PLAN)

TYPE OF STRUCTURE/ STREAM COURSE	RESIDENTIAL	GARAGES/ SHEDS	COMMERCIAL	SCHOOLS	RECREATIONAL
FOLLY	21	20	4	1	-
LOTTSFORD	-	8	-	-	-
BALD HILL	28	14	-	-	2
NORTHEAST	-	7	1	-	-
SOUTHWEST	20	16	12	-	2
TURKEY	4	1	-	-	-
CABIN	1	4	-	-	-
BACK	-	3	-	-	-
FEDERAL SPRING	6	6	2	-	-
COLLINGTON	11	4	1	-	-
WESTERN (Main Stem)	19	31	70	-	-
T O T A L	110	114	90	1	4

. 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.

. 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 garage/sheds and 2 commercial structures on the south side of Old Marlboro Pike near the driveway on 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.

. Collington Branch

Under existing land use, 8 residential structures, 2 garages/ sheds are within the floodplain. On the basis of future land use plans a total of 11 residential, 4 garages/sheds and 1 commercial structure are in the flood plain. Most of the houses are located on Peerless Avenue near the confluence of Collington and Western Branches. Four of these structures are located in the Bowie area close to Route 214. The Brady Building at the intersection of Route 197 and 450 has also been identified as flood prone and its flooding is due to the inadequate culvert capacity under State Route 450.

. Western Branch

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.

5.2 Erosion and Sedimentation

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 Glen Dale Road Crossing. Erosion of the exposed slopes on the right overbank upstream of Glen 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, at Old Marlboro Pike crossing.

. 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 Route 202 & 301 bridge openings and this would affect the conveyance capacity of the structures.

5.3 Water Quality

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. 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 5.

An analysis of Table 5 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.

TABLE 5

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	6
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

5.4 Conservation Areas

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, are noted here. 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 ripple beneath the bridge at Water Street in Upper Marlboro may be a barrier to the upstream migration of these species.

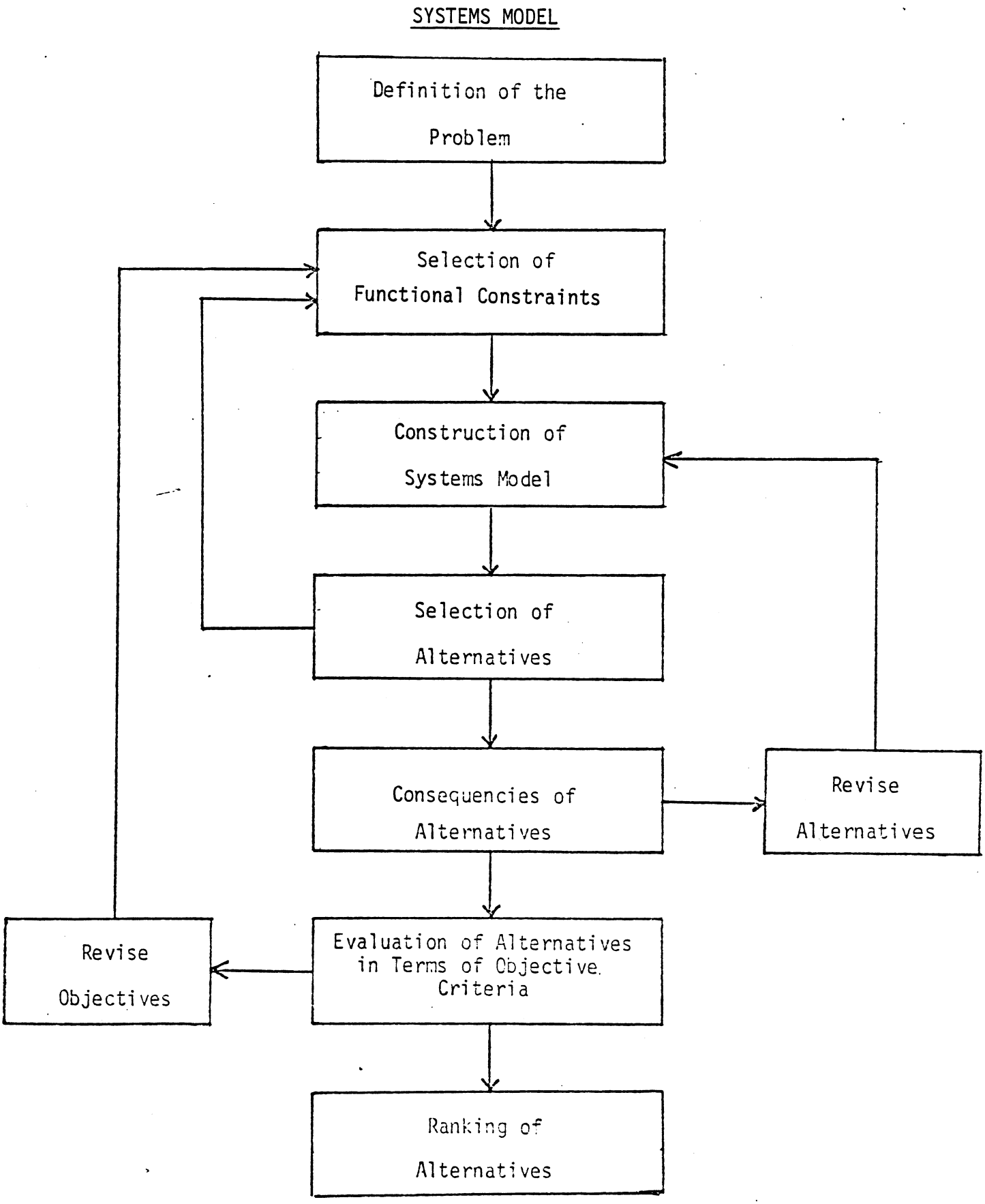
6.0 CONSTRUCTION OF A SYSTEMS MODEL

To alleviate present and future problems, a step-wise watershed management model was employed. This model includes:

- Definition of the problem
- Selection of functional constraints
- Selection of alternatives
- Consequences of alternatives
- Evaluation of option in terms of the objective criteria (problem minimization)
- Iteration
- Selection of an option

The systems model flow diagram is shown on the next page in schematic form.

FIGURE 2


SYSTEMS MODEL
Definition of the Problem
Selection of Functional Constraints
Construction of Systems Model
Selection of Alternatives
Consequencies of Alternatives
Revise Alternatives
Revise Objectives
Evaluation of Alternatives in Terms of Objective Criteria
Ranking of Alternatives

7.0 CONSTRAINTS

In a comprehensive watershed study it is often deemed necessary to confine corrective and preventive measures within defined boundary conditions to eliminate solutions or measures that are undesirable. The boundary or the feasible region is defined or perimetered by the introduction of functional constraints. Those used in this study include:

(a) A mitigation measure in one area of the watershed should not create a problem or exacerbate an existing problem in another area.

(b) The solution should have a measure of relative constancy and permanency.

(c) The solution should be technically effective and also cost effective.

8.0 SELECTION OF ALTERNATIVES

Based on the susceptibility of several structures to flooding within the watershed and the relative magnitude of the consequences of such an event, flooding is considered the major problem in the basin. Study efforts were therefore concentrated towards those alternatives both structural and non-structural that have flood mitigation characteristics. Structural measures are those that involve design and construction-related activities. These include stream channel improvements (channelization), levees, flood walls, protective dams and reservoirs. Non-structural measures include flood plain management, land use planning, flood proofing and Flood Watch/Flood Warning, acquisition and relocation of flood prone structures.

8.1 Flooding

A series of alternatives were considered for each major source of flooding identified in the technical data base report. The alternatives are described in this section by stream course.

FOLLY BRANCH

Flooding on this branch is caused by stream overflow and back water effects due to artificial flow obstruction. The major obstruction occurs at the Conrail railroad crossing of the main stem downstream of Lanham-Severn Road. The inadequacy of the existing culvert at that point causes the flooding of some residential structures in the immediate vicinity. In the future unmitigated flows will result in increased flooding of homes in the Glenn Dale area of Northern Avenue and Potomac Street. To a lesser extent flow constriction by the abandoned Route 704 road embankment has caused some flooding in the Glenwood Park and the Lincoln subdivisions. Nonetheless, the obstruction has had some positive effect by reducing flood magnitudes and levels downstream.

Several measures, structural and non-structural, were considered as solutions to the identified problems.

The non-structural measures considered within this sub-watershed are:

Acquisition - This solution calls for the acquisition and relocation of all the affected structures within the 100-year flood limits. Such an acquisition scheme would cost approximately 3.5 million dollars. Reduced Zoning Intensity - An attempt was made to minimize stream flow by mathematically reducing the degree of imperviousness in the sub-watershed to allow for increased infiltration. This was accomplished by hypothetically creating large lot zones with minimal ground cover (not more than 2 percent lot coverage), on vacant land areas. Owing to the nature of flooding along this tributary, this measure alone was found ineffective in alleviating even existing problems.

Flood Insurance and Flood Warning Program - This measure consists of a program to offically notify the owners of flood prone structures of the availability of federally subsidized flood insurance and to recommend the purchase of adequate insurance coverage. This program would be supplemented with an early flood warning system to advise the residents of flood areas of an impending flood event. Although such a measure requires minimal funding to implement, it has several draw backs. It would not alleviate identified problems and might give area residents an illusionary feeling of adequacy and safety due to the early warning system. It might also encourage future flood plain encroachment.

Flood Proofing - This solution would involve flood protection of individual structures by floodwalls, by water proofing of basements,

constructing waterproof utility rooms and raising of structures. This measure, however, has limited applicability. It is effective for areas with flooding depths of 3 feet or less. It does not reduce the magnitude of flood flows and has little or no benefit on erosion, sedimentation or water quality problems.

The structural measures considered in Folly Branch include:

Channelization - Folly Branch has relatively shallow banks and flat slopes, with relatively low velocities. Because of these characteristics, a channelized segment would be subject to frequent siltation problems requiring continual maintenance. Due to its high initial cost and extensive maintenance requirements, channelization was dismissed as a feasible solution within this sub-watershed.

Levees - Such a measure was considered and dismissed, because of the proximity of the flood-prone structures to the stream. A levee system as a management technique here would be impractical and costly.

Conrail Culvert Enlargement - This measure proposes to enlarge the culvert size under the Conrail crossing. The flooding encountered in the upper reaches of the watershed is due to the inadequate culvert capacity under Conrail. Substantially increasing the culvert capacity would substantially reduce the number of flood-prone structures in the area. The cost of enlarging an opening through a Railroad Embankment is linearly proportional to the size of the opening up to a 6 foot diameter. Above a 6 foot diameter opening, the cost escalates drastically, and approximates an exponential function. Because of cost considerations, 3 openings each of 6 foot maximum diameter are proposed. While enlarging the existing opening would improve the condition, it would no doubt aggravate flooding downstream. Consequently such a measure is recommended only if other measures are to be implemented to improve downstream condition.

Detention - A regional detention basin approximately 5000 feet downstream of Conrail railroad crossing would alleviate flooding within the Lincoln Subdivision as well as the Glenwood Park Subdivision. A 300 acre-foot basin at this site could have multi-purpose uses. If constructed in conjunction with enlarging the opening under 'Conrail' the flooding of most structures in the area would be eliminated.

ALTERNATIVES

As a result of the complex nature of flooding within this sub-watershed, no one measure was found to be fully effective in alleviating the identified problems. An attempt was therefore made to combine some of the measures discussed previously. The combinations are referred to in this section as alternatives.

Alternative A: This alternative includes (1) rezoning of the subwater shed upstream of the Conrail railroad crossing, to categories of lower density or intensity, (2) increasing the size of the Conrail railroad bridge opening from a 72 to an approximate 144 square foot opening, (3) constructing a 300 acre-foot detention basin immediately upstream of the Lincoln Subdivision, (4) removing the abandoned Route 704 embankment and, (5) flood proofing of 4 residential structures. This alternative would alleviate the flooding of the 21 flood prone residential structures, the Lincoln Resource Center, and a number of sheds. The value of the residential protected structures is approximately $1.5 million dollars. The value of the Lincoln Resource Center is approximately 1.0 million dollars. The construction cost of the projects associated with this alternative is estimated at 1.6 million dollars. Flood proofing of some flood prone residential properties is estimated at $28,000. This alternative has the advantage of minimal adverse environmental effect. The detention basin is proposed immediately downstream of the improved channel section downstream of the Conrail railroad crossing, and any reduction in discharge would also reduce the potential for stream bank erosion.

Alternative B: This allows for the development of the sub-watershed as zoned in the Comprehensive Rezoning map (Reference 5) and includes (1) increasing the size of the Conrail railroad bridge from a 72 to an approximate 144 square foot opening, (2) the removal of the abandoned Route 704 embankment, (3) construction of a 300 acre-foot detention basin immediately upstream of the Lincoln Subdivision, (4) increasing the size of the proposed detention facility within the "Wingate" Subdivision proposal and (5) the flood proofing of 6 residential structures. The total cost of this alternative is estimated at $1.6 million dollars. Like alternative A, this scheme is well balanced. Since the structural portion is the same, this scheme will have a positive effect on erosion and sedimentation. The overall environmental impact would also be minimal.

Alternative C: This combines all the elements of Alternative A with an increase in the size of the proposed detention facility within the "Wingate" Subdivision proposal. This scheme has no effect in removing any additional structures from the floodplain. Thus, this scheme

offers no advantage over the first two schemes. The construction of this basin would be redundant, as presently undeveloped tracts are recommended for reduced density/intensity zoning. However, if this area were allowed to develop as currently zoned such a facility would have a positive impact on erosion and sedimentation.

Alternative D: This involves all the elements of Alternative B but with the abandoned Route 704 embankment unremoved. The construction of the proposed detention basin upstream would significantly reduce the flow quantities at the embankment location, thereby minimizing its back water effect on Glenwood Park and Lincoln Subdivisions. However, the embankment still creates a marginal flooding condition around the Lincoln Resource Center. Thus its removal is recommended. Its removal would cost approximately $140,000.

Alternative E: This scheme involves the individual flood proofing of identified flood-prone structures using concrete walls.

A comparison of the flow reduction effectiveness of the alternatives is presented in Table 6.

TABLE 6

FLOW REDUCTION EFFECTIVENESS OF ALTERNATIVES

(FOLLY BRANCH)

ALTERNATIVES / LOCATIONS	A	B	C	D	E
Discharge D/S of Proposed Regional Basin	2091* / 1031+	2091 / 1286	2091 / 1031	2091 / 1286	2091 / 2091
Elevation at same Location	118.6# / 114.5Δ	118.6 / 115.0	118.6 / 114.5	118.6 / 115.0	118.6 / 118.6
Discharge U/S of Proposed Basin	2091 / 2105	2091 / 2211	2091 / 2105	2091 / 2211	2091 / 2091
Elevation at Same Location	118.6 / 120.8	118.6 / 121.4	118.6 / 120.8	118.6 / 121.4	118.6 / 118.6
Discharge of D/S of "Conrail"	916 / 892	916 / 1420	916 / 892	916 / 1420	916 / 916
Elevation at Same Location	125.6 / 122.4	125.6 / 126.0	125.6 / 122.4	125.6 / 126.0	125.6 / 125.6
Discharge U/S of "Conrail"	2604 / 1247	2604 / 2603	2604 / 1247	2604 / 2603	2604 / 2604
Elevation at Same Location	132.7 / 122.9	132.7 / 126.2	132.7 / 122.9	132.7 / 126.2	132.7 / 132.7

*Discharge without management
+Discharge with management alternative

#Elevation without management
ΔElevation with management alternative

. Bald Hill Branch.

In addressing the flooding problems identified within this sub-watershed, several alternatives were considered. The alternatives consist of structural and non-structural solutions. These alternatives are:

Alternative A: This scheme invovles: (a) the construction of a 90 acre-foot detention basin approximately 1,100 feet upstream of Good Luck Road. This basin with an embankment height of 16 feet is proposed as a dry pond designed to completely drain after a flood event. The proposed detention basin will have a surface area of 22 acres of which 14.5 acres is floodplain land. The land cost for this facility is estimated at $110,000.00 with the construction cost approximated at $270,000, (b) flood-proofing of 11 minimally flooded houses (depth of flooding is 0.1 to 0.3 foot) and (c) acquisition and relocation of one flood prone house.

This alternative would alleviate the flooding of all identified residential flood prone structures in this watershed.

Alternative B: This plan would involve increasing the size of the opening underneath the Conrail railroad crossing of Bald Hill Branch. A new 6 foot diameter opening is proposed in addition to the existing 6 foot diameter opening and the acquisition and relocation of 14 flood prone residential structures. The total cost of this scheme is approximately $1.33 million dollars.

Alternative C: This measure would involve (1) the construction of a 68 acre foot "dry" detention basin with a 10 foot embankment on a tributary of Bald Hill Branch upstream of Presley Road, and (2) the acquisition and relocation of 12 residential structures remaining in the floodplain, and two residential structures that would be flooded due to the construction of the "dry" detention basin. The total cost of this alternative is estimated at 1.66 million dollars.

Alternative D: This measure entails the acquisition and relocation of all floodprone structures within this sub-watershed. The cost of such a plan is estimated at 2.38 million dollars.

The effectiveness of each alternative in reducing flood flows is shown in Table 7.

TABLE 7

FLOW REDUCTION EFFECTIVENESS OF ALTERNATIVES

(BALD HILL BRANCH)

ALTERNATIVES / LOCATIONS	A	B	C	D	E
Discharge at Lanham Severn Road	1839 * / 1284 +	1839 / 1820	1839 / 1320	1839 / 1839	1839 / 1839
Elevation at Same Location	138.0 # / 136.0 Δ	138.0 / 136.3	138.0 / 136.4	138.0 / 138.0	138.0 / 138.0
Discharge at 4th Street	1839 / 1149	1839 / 1795	1839 / 1290	1839 / 1839	1839 / 1839
Elevation at Same Location	138.2 / 136.3	138.2 / 136.8	138.2 / 136.7	138.2 / 138.2	138.2 / 138.2
Discharge at Tuckerman Lane	1752 / 889	1752 / 1810	1752 / 1365	1752 / 1752	1752 / 1752
Elevation at Same Location	139.3 / 137.5	139.3 / 138.7	139.3 / 138.0	139.3 / 139.3	139.3 / 139.3
Discharge at Good Luck Road	1752 / 889.0	1752 / 1810	1752 / 1365	1752 / 1752	1752 / 1752
Elevation at Same Location	141.6 / 138.3	141.6 / 141.76	141.6 / 139.8	141.6 / 141.6	141.6 / 141.6

*Discharge without management
+Discharge with management alternative

#Elevation without management
ΔElevation with management alternative

. Northeast Branch

For the 1 commercial building in the floodplain, floodproofing is considered the most cost effective measure and should be recommended to the owner of the structure. No mitigation measures were considered for the sheds/garages.

. Southwest Branch

Three management alternatives comprising structural and non-structural measures were considered for this sub-watershed. They are:

Alternative A: This involves (a) the construction of a 440 acre-foot detention facility, approximately 2,200 feet upstream of Walker Mill Road on Southwest Branch. The drainage area to this site is 2.83 square miles and has a future 100 year discharge of 4400 cfs. The proposed embankment would have a maximum height of 33 feet measured from the channel invert and a length of 650 feet and would require approximately 50,000 cubic yards of fill material. The pond would have a 5 to 6 feet depth of permanent pool for recreation, (b) a 400 acre-foot dry pond located approximately 4500 feet upstream of Harry S. Truman drive. The pond's embankment would be approximately 21 feet high and 1300 feet long and require approximately 40,000 cubic yards of fill material. The drainage area to the site is approximately 10.98 square miles and (c) acquisition and relocation of 7 residential structures. The estimated cost of the detention basins is 1.65 million dollars (0.6 million dollars for Walker Mill Park basin and 1.05 million dollars for the Harry S Truman Drive basin). With the estimated cost of relocation of the 7 residential structures at 0.65 million dollars, the total estimated cost of this alternative is 2.3 million dollars.

Alternative B: This plan involves elements (a) and (b) of Alternative A plus the individual flood proofing of 7 residences. The estimated cost of the 2 detention basins is 1.65 million dollars and flood-proofing of the remaining 7 residential structures is approximately at $50,000. The total estimated cost of this alternative is 1.70 million dollars.

Alternative C: This scheme entails the construction of only the 400 acre foot detention facility upstream of Walker Mill Road and the flood proofing of 9 residential structures that would still be susceptible to flooding. Floodproofing of the 9 residential structures would cost approximately $63,000, and the cost of the Walker Mill Road basin is approximately $600,000. This alternative would therefore cost $663,000 approximately.

Table 8 which compares the flow-reduction effectiveness of the alternatives, shows that the addition of the detention basin at the Harry S Truman Drive does not result in significant flood flow reduction. The cost of this facility could therefore not be justified on the basis of this benefit only. However, the construction of this facility would reduce the magnitude and levels of flood flows on the main stem of Western Branch where significant flooding problems presently exist. On the basis of its

flow reduction effectiveness on the main stem, the construction of this basin is deemed desirable.

Alternative D: This scheme involves the elements of Alternative B with the additional considerations of improving the D'Arcy Road crossing on Ritchie Branch for use as a flood retarding structure. At the present, the road has a minimum elevation of 180 feet mean sea level at the left overbank, and 185 feet at the channel crossing. The road profile rises steeply on each overbank, to an elevation of 195 feet and within approximately 250 and 630 feet on the left and right overbanks respectively. To improve the road would require raising it by 9 feet to a minimum elevation of 194 feet for a length of 600 feet. The improvements would include the replacement of the existing 84 inch diameter corregated metal pipe with a 90 inch reinforced concrete pipe to achieve an outflow from the site of 880 cfs. Total cost of these improvements is estimated at $178,000.00. It was determined through the watershed model that although the scheme gave approximately a 25% reduction in flows in Ritchie Branch with the increased storage behind the road; the effects rapidly diminished downstream. In the proximity of the flood-prone structures on Ritchie Branch; between Ritchie and Walker Mill Roads, the discharge representative of this stream reach does not change significantly from the unmodified conditions, without the road improvements. Without the D'Arcy Road improvement 2 of the flood-prone structures along Ritchie Branch would be removed from the flood plain due to the lowered backwater elevations, at the confluence with Southwest Branch from the Walker Mill Park Basin. Thus this reduction in flood elevations along the lower reach of Ritchie Branch could be achieved by the establishment of the Walker Mill Park Site on Southwest Branch. It is therefore not recommended that this road improvement be undertaken solely for its stormwater management effects.

TABLE 8

FLOW REDUCTION EFFECTIVENESS OF ALTERNATIVES

(SOUTHWEST BRANCH)

ALTERNATIVES / LOCATIONS	A	B	C	D	E
Discharge U/S of Ritchie Road	5705* / 2877+	5705 / 2877	5705 / 2877		
Elevation at Same Location	129.7 # / 127.3 Δ	129.7 / 127.3	129.7 / 127.3		
Discharge at Hampton Mall	5265 / 3147	5265 / 3147	5265 / 3147		
Elevation at Same Location	120.2 / 118.5	120.2 / 118.5	120.2 / 118.5		
Discharge D/S of Harry S. Truman Dr.	8597 / 6272	8597 / 6272	8597 / 7623		
Elevation at Same Location	85.6 / 84.7	85.6 / 84.7	85.6 / 85.1		
Discharge at Woodlawn Blvd.	8597 / 6272	8597 / 6272	8597 / 7623		
Elevation at Same Location	73.6 / 72.6	73.6 / 72.6	73.6 / 73.1		

*Discharge without management
+Discharge with management alternative

#Elevation without management
ΔElevation with management alternative

- Turkey Branch

For the 4 residential structures and 1 shed/garage identified as flood prone, individual floodproofing was determined as the most cost effective measure. The approximate cost of this measure is $28,000.

. Cabin Branch

The one flood prone residence is situated in the middle of the flood plain. The most cost effective flood control measure here is determined to be acquisition and relocation. Any future improvement to Ritchie Marlboro Road would necessitate the purchase of this house because of its proximity to the road. Assuming that the road would not be improved in the immediate future, the purchase of this house under the flood mitigation program is recommended. The house has an assessed value of $18,000. Acquisition and relocation is estimated at $30,000.

- Back Branch

Only 3 garages/sheds are identified as susceptible to flooding in this subwatershed. As a result no mitigation measures are recommended.

. Federal Spring Branch

Five Management Alternatives were considered and analyzed for this subwatershed. These include:

Alternative A: This plan would require the acquisition and relocation of all the flood prone residential structures within the 100 year flood plain. The total cost of acquisition and relocation is estimated at $330,000. Although relocation would alleviate flooding of structures, it would neither reduce the magnitude nor the levels of flood flows in the lower segments of the stream.

Alternative B: This alternative consists of two detention basins and the relocation of 3 residential structures. One detention basin is proposed on tributaries (3) and (2) which have their confluences with Federal Spring Branch near its headwaters. Tributary (3) joins Federal Spring Branch approximately 3,300 feet upstream of Ritchie-Marlboro Road after it (Trib. 3) passes under William Beanes Road (W.B. Road) and State Route 4. Tributary 2 joins Federal Spring approximately 2,200 feet upstream of Ritchie- Marlboro Road after it (Trib. 2) passes under W. B. Road and State Route 4. The detention basin is proposed so as to collect the flows of both tributaries on the upstream side of W. B. Road. Outflow from the detention would be through Tributary 2's existing culvert. A riser would have to be added to handle the emergency flows. An embankment would not be required to create this basin. The other basin is proposed on the main stem of Federal Spring Branch near its headwaters, approximately 3,200 feet upstream of Ritchie-Marlboro Road at the inlet to the 650 feet long culvert which parallels Route 4 in this area. Storage behind this existing culvert would be achieved by reducing the size of the present opening. An embankment would be required at the present inlet to achieve the desired head. Flow of a 100 year frequency could be handled by the existing pipe and flows greater than that event would be handled by a spillway. The two proposed detention basins would remove all but 3 residential structures from the flood plain. Acquisition and relocation of the 3 residences remaining flood prone would cost approximately $140,000. The total approximate cost of this alternative is $440,000.00. With this alternative the road over-topping problems at W. B. Road and and on Old Marlboro Pike would still persist. Indeed the flooding problems would become much more severe as W. B. Road would be under as much as 7 feet of water during a 100 year flood event at ultimate development and under approximately 15 feet of water with the detention basin on Tributaries 2 and 3 in place. In addition, the flooding of the driveways to 2 residences south of W. B. Road between Tributaries 3 and 2 would be aggravated. Access to these two residences is through the flooded portion of Marlboro Pike. During a 100-year flood ingress and egress from the south end would be extremely difficult.

Alternative C: This plan consists of three detention basins and the acquisition and relocation of 1 residential structure. Two of the basins were described previously -- one on Tributaries 3 and 2, the other on the main stem near the headwaters of Federal Spring Branch and a third also on the main stem but approximately 3,000 feet downstream of Ritchie-Marlboro Road. The total cost of this alternative is estimated at $770,000.

Alternative D: This alternative combines the effects of the three detention basins described under Alternative C with a detention basin proposed on Tributary 2 at a location approximately 1,000 feet upstream of Old Marlboro Pike. Included in this alternative is the acquisition and relocation of 1 residential structure. The cost of the detention basins is estimated at 1 million dollars; acquisition and relocation of the one structure is approximated at $50,000.

Alternative E: This plan proposes the construction of a levee on the south side of Old Marlboro Pike between Brown Station Road and the Marlboro Country Club driveway and relocation of some structures. The levee would have an average height of approximately 5.5 feet and would be approximately 530 feet long. This levee would tie into the natural topography approximately 100 feet west of the most upstream house, approximately in line with Brown Station Road. It would then extend in an easterly direction approximately 400 feet behind some residential structures and then northwards, eventually abutting Old Marlboro Pike approximately 50 to 100 feet west of the Marlboro Country Club driveway. At this point Old Marlboro Pike is below the 100 year flood elevation. To prevent flanking of the levee it would be necessary to construct a flood proof brick wall parallel to Old Marlboro Pike upslope to the 40' contour. This wall would extend to the driveway of the most downstream house. The wall would have an average height of approximately 5 feet and would be approximately 125 feet long. This levee system would alleviate the flooding of 4 houses and would cost approximately $56,000. The acquisition and relocation of the remaining 2 flood prone residences would cost an additional $45,000 approximately.

The flow reduction effectiveness of all the alternatives considered in this sub-watershed are shown in Table 9.

TABLE 9

FLOW REDUCTION EFFECTIVENESS OF ALTERNATIVES

(FEDERAL SPRING BRANCH)

ALTERNATIVES / LOCATIONS	A	B	C	D	E
Discharge of U/S of Old Marlboro Pike	2200* / 2200+	2200 / 1770	2200 / 880	2200 / 770	2200 / 2200
Elevation at Same Location	36.8 # / 36.8 Δ	36.8 / 36.3	36.8 / 34.8	36.8 / 34.3	36.8 / 36.8
Discharge at 500 feet U/S of Old Marlboro Pike	2200 / 2200	2200 / 1770	2200 / 880	2200 / 770	2200 / 2200
Elevation at Same Location	37.2 / 37.2	37.2 / 36.7	37.2 / 35.3	37.2 / 34.9	37.2 / 37.2
Discharge at 300 feet U/S of Ritchie Marlboro Road	2930 / 2930	2930 / 1410	2930 / 1410	2930 / 490	2930 / 2930
Elevation at Same Location	71.3 / 71.3	71.3 / 65.4	71.3 / 65.2	71.3 / 60.8	71.3 / 71.3

*Discharge without management
+Discharge with management alternative

#Elevation without management
ΔElevation with management alternative

. Collington Branch

Mitigation measures such as channelization, enlarging the size of the bridge opening under Route 450, and on-site detention facility on individual developments were considered, and dismissed as being outside the region of feasible solution given the functional constraint of a measure of constancy and permanency. Stream Channelization in the reach upstream of Central Avenue would not be effective, owing to the flat slopes and shallow banks in this area. It would be expensive and have a tremendous adverse environmental effect because of the large quantity of vegetation that would have to be removed. In addition, the channel would have to be wide and would require a large excavation project with massive erosion and sedimentation potential. Such a channel project also would not reduce the magnitude or levels of flood flows in the area.

Enlarging the opening under Route 450 would reduce the flood elevation at that section and thus alleviate or minimize the flooding of the Commercial Structure (Brady Building). However, this is a very expensive operation, and would not reduce flood flows in downstream segments of Collington Branch or reduce the magnitude of flooding in the Town of Upper Marlboro.

On-Site Detention facilities have to be effectively maintained to remain useful as flood abatement measures. The administration and maintenance cost of such a program would be very high.

The two alternatives that were considered and analyzed, within the realm of feasible solutions are:

Alternative A: This plan proposes the individual floodproofing of 5 residential structures and the acquisition and relocation of 6 residences located near the Town of Upper Marlboro. Flooding of the 5 residential structures is marginal and could be alleviated by individual flood proofing measures. Four of the 6 residences are in Upper Marlboro and are scheduled to be razed and have only minimal current values. The other 2 which are currently estimated at $72,500 are inundated to depths of over 6 feet. These 2 are therefore proposed for acquisition and relocation. The total cost of floodproofing the residential structures is approximately $35,000. The acquisution and relocation of the two valued structures for which floodproofing is not suitable, is estimated at $91,000. This alternative, though effective, would not reduce flood flows that presently contribute to the significant flooding problems in the Town of Upper Marlboro.

Alternative B. This plan proposes (1) the construction of a 3,000 acre-foot dry detention basin with a 25 foot high embankment approximately 7500 feet downstream of LeeLand Road (south). The basin would significantly reduce the flood flows in the lower reaches of Collington

Branch. The cost of constructing the basin is approximately 1.7 million dollars. The basin would also have a significant reduction effect on flood flows along Western Branch main stem below the confluence point and as such could be considered as part of the overall solution to the flooding problems around the Town of Upper Marlboro. (2) Flood-proofing of 6 residential structures, estimated at $42,000.

A comparison of the flow reduction effectiveness of the two alternatives is shown in Table 10.

TABLE 10

FLOW REDUCTION EFFECTIVENESS OF ALTERNATIVES

(COLLINGTON BRANCH)

ALTERNATIVES / LOCATIONS	A	B	C	D	E
Discharge at Peerless Avenue	5162 * / 5162 +	5162 / 5162			
Elevation at Same Location	31.7 # / 31.7 Δ	31.7 / 26.5			
Discharge at U/S of "Conrail"	5162 / 5162	5162 / 2182			
Elevation at Same Location	31.2 / 31.2	31.2 / 26.0			

*Discharge without management
+Discharge with management alternative

#Elevation without management
ΔElevation with management alternative

. Western Branch (Main Stem).

The mitigation alternatives considered for the tributaries had beneficial effects on the main stem. They were considered separately and in combination as essential components of the alternatives analyzed for the main stem. In addition, a lake and dam under construction on Northeast Branch approximately 1200 feet upstream of Woodmore Road was included as a component of each alternative considered. The essential elements of the alternatives considered are described with each.

Alternative A: This consists of: (1) a 2400 acre-foot wet detention basin located in the area of Watkins Regional Park. The dam would be located approximately 3400 feet upstream of Largo-Marlboro Road. It would contain four 84 inch pipes, and have a top elevation of 75.0 feet Mean Sea Level (MSL). Total flood storage at the top elevation is 2,380 acre feet, with a release rate of 6,500 cfs. This basin would produce a net decrease in future 100-year flow of approximately 3,888 cfs from the original flow of 8,037 cfs. The net decrease in the present 100-year flood flow would be approximately 2,558 cfs from the original flow of 6,371 cfs. Estimated cost of the structure is 1.5 million dollars. Utilized storage for the 100-year future flow would be approximately 1,800 acre feet, with a pool elevation of 72.7 feet (MSL), and surface area at this elevation of approximately 200 acres, (2) a levee system along the left bank of the river between Route 301 (southbound) and "Conrail", with a total length of approximately 1000 feet and an average height of 4 feet. The estimated cost of this levee is $30,000, and (3) a levee system consisting of upgrading the existing levee-waterproof fence system on the west bank of the river, extending from Water Street approximately 1,800 feet upstream. Presently it has an effective top elevation of 21 feet (MSL), even though it was designed to be 23 feet (MSL). Raising the effective top elevation of this system to 26 feet (MSL) would remove approximately 3.6 million dollars worth of County office and service buildings from the flood plain. The cost of providing additional levee height, by adding fill or having metal sheets driven into the top of the levee, and replacing the current metal waterproof fence with a taller concrete fence is estimated at $500,000.

The total cost of this alternative is approximately 5 million dollars and would alleviate the flooding of 42 commercial establishments, 7 residences and 12 sheds/garages. The remaining 12 flood prone residences would be left in status quo and their owners encouraged to purchase federally subsidized flood insurances.

Alternative B: This combines all the elements of alternative A with a flood-proofing program for the 11 of the 12 residential structures remaining in the flood plain. The estimated cost of the flood-proofing

program is $80,000. The remaining flood prone residential structure would be acquired and relocated at an approximate cost of $13,000.

Alternative C: This alternative is similar to alternative B but replaces the flood-proofing program with a relocation and acquisition program. The cost of relocation and acquisition is estimated at $600,000.

An alternative that was offered by the Department of Public Works, after the study was finalized, involves filling in the low lying areas adjacent to the existing levee system upstream of Water Street in lieu of upgrading it. This alternative will be anlayzed and assessed during the design study phase.

Table 11 Compares the flow reduction effectiveness of the alternatives.

TABLE 11

FLOW REDUCTION EFFECTIVENESS OF ALTERNATIVES

[WESTERN BRANCH (MAIN STEM)]

ALTERNATIVES / LOCATIONS	A	B	C	D	E
Discharge at Main Street (Upper Marlboro)	20080 * / 12350 +	20080 / 12350	20080 / 12350		
Elevation at Same Location	29.6# / 26.0Δ	29.6 / 26.0	29.6 / 26.0		
Discharge at Water Street (Upper Marlboro)	20080 / 12350	20080 / 12350	20080 / 12350		
Elevation at Same Location	27.4 / 24.5	27.4 / 24.5	27.4 / 24.5		
Discharge at Route 4	20080 / 12350	20080 / 12350	20080 / 12350		
Elevation at Same Location	27.4 / 23.2	27.4 / 23.2	27.4 / 23.2		
Discharge at Route 301	20080 / 12350	20080 / 12350	20080 / 12350		
Elevation at Same Location	21.0 / 13.4	21.0 / 13.4	21.0 / 13.4		

*Discharge without management
+Discharge with management alternative

#Elevation without management
ΔElevation with management alternative

8.2 EROSION AND SEDIMENTATION

Erosion

The erosion of stream bank areas in the watershed is ascribable to the hydraulic characteristics of overbank flow, the erodibility potential of the bank materials and the steep-slope factor of channel overbank areas. it is recommended that changes in stream channel composition by using gabions, rip rap and lattice blocks be undertaken. For channel overbank areas, a conscious program of revegetation and steep-slope grass "breaks" should be initiated.

- Downstream of the Conrail railroad crossing on the main stem of Folly Branch, the wall retaining the back fill for sewer line is deteriorating. Corrective repairs should be taken to prevent the eventual failure of this retaining wall.

- The concrete channel immediately downstream of Conrail railroad crossing on Bald Hill Branch is severely cracked. Seepage and undermining activities are evident, and could result in significant damage. Immediate corrective action should be taken to prevent collapse.

- In the vicinity of Hampton Mall along the channelized segment of Southwest Branch, there are significant problems. The concrete sides are being undermined by seepage, due to poor channel alignment. This channel section should be given immediate attention to prevent major channel damage.

- A portion of the right embankment of the entrance ramp onto Route 50 from Route 704 is eroding and sloughing could occur leading to sedimentation. Since Routes 50 and 704 are State owned and maintained roads, the State Highway Administration should be immediately notified of this condition.

Sedimentation

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.

- 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 qauality. 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.

- Features preventing the introduction of runoff from impervious surfaces directly into receiving waters should be incorporated into storm water management plans.

- A large population of beavers exist downstream of Route 50 on Bald Hill Branch as evidenced by a series of recently constructed beaver dams, and severe siltation problems. The dams have altered flow characteristics in the area and could cause the over-topping of Route 50 during a flood event. It is recommended that the beavers be trapped.

8.3 WATER QUALITY

In some segments of the Western Branch Stream system, there are relatively high concentrations of fecal coliform. It is difficult to determine the origin of high fecal coliform levels as they may result from urban or agricultural runoff, overloaded septic tanks, broken sewer mains or deliberate discharges. To assist in establishing a distinction between human and animal pollution in the waters of Western Branch, it is recommended that the Health Department be requested to initiate a stream program which includes analysis for fecal streptococcus as well as fecal coliform.

- Sensitive site planing which retains natural drainageways, minimizes impervious surfaces, retains vegetative cover, maximizes the distance between development activities and drainageways and maximizes the soil's infiltration capacity should be encouraged.

- Whenever possible natural drainage, contour landscaping, dutch drains, porous or permeable pavement, grass lined swales and infiltration pits and trenches should be incorporated into development schemes.

- The use of "Best Management Practices" such as street/parking lot sweeping, fertilizer management activities, modification of local road design standards and specifications to allow for road side grassed swales in medium density single-family land uses in place of curbs and gutters, should be encouraged.

9.0 FLOW REDUCTION EFFECTIVENESS OF ALTERNATIVES

All the alternatives considered were simulated separately and in appropriate combinations using computer programs TR-20 and HEC 2. (References 6 and 7, respectively), to test their effectiveness in reducing the magnitude and levels of floods throughout the watershed. Tables showing the flow reduction effectiveness of each alternative have been included in this report, and are presented by water course (Tables 6 through 11).

10.0 EVALUATION AND RANKING OF ALTERNATIVES

10.1 Evaluation

The alternatives were evaluated on the basis of their effectiveness in reducing the magnitude and levels of flood flows within the sub-watersheds and within the Town of Upper Marlboro, and were compared on the basis of costs and benefits. For the purposes of comparing the relative merits of the alternatives, the total cost of the elements of the alternative was compared with the number of residential structures alleviated from flooding by the alternative. The total number of residential structures protected from flooding has been used in this study to define the benefits of each alternative.

Tables 12 through 17 inclusive show the benefit-cost comparison of the alternatives considered for each sub-watershed.

10.2 Ranking of Alternatives

On the basis of cost-effectiveness and flow-reduction effectiveness, the various alternatives were ranked in descending order of preference. The ranking is presented in this section by water course.

FOLLY BRANCH:

1. Alternative A
2. Alternative D
3. Alternative C
4. Alternative B
5. Alternative E

FEDERAL SPRING BRANCH:

1. Alternative E
2. Alternative A
3. Alternative B
4. Alternative C
5. Alternative D

BALD HILL BRANCH:

1. Alternative A
2. Alternative B
3. Alternative C
4. Alternative D

COLLINGTON:

1. Alternative B
2. Alternative A

SOUTHWEST BRANCH:

1. Alternative B
2. Alternative A
3. Alternative D
4. Alternative C

WESTERN BRANCH (MAIN STEM):

1. Alternative B
2. Alternative C
3. Alternative A

TABLE 12

BENEFIT-COST COMPARISON OF ALTERNATIVES

FOLLY BRANCH
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sch.	Sheds	Value
ALT. A	Reduction of Zoning Intensity/ Density	Area above Conrail							
	6' Tunnel	3 - 105' Long 25% Contingency 15% Eng. & Overhead	450,000 112,500 84,375	14	6	-	-	8	311,413
		Total Cost	646,875						
	Detention Basin	1 - 300 ac-ft Construction cost including 25% contingency & 15% eng. & overhead	193,344						
		Floodplain Land 68 acres @ $4,000 22 acres @ $7,000	 272,000 154,000						
		Total Cost*	619,344	15	11	-	1	3	1,839,840
		*Utility Relocation not included							
	Embankment Removal (Abandoned Rt. 704)	1400 C.Y.(including 25% contingency & 15% eng. & overhead)	140,228						

TABLE 12

BENEFIT-COST COMPARISON OF ALTERNATIVES

FOLLY BRANCH
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sch.	Sheds	Value
ALT. A (cont'd)	Floodproofing	4 Indiv. 3' walls @ $7,000 each	28,000	4	4	-	-	-	313,344
			1,434,447	33	21	-	1	11	2,464,597
					TOTAL ALTERNATIVE A				2,464,597
ALT. B	6' Tunnel	3 - 105' Long(including 25% contingency & 15% eng. & overhead)	646,875	8	4	-	-	3	290,000
	Detention Basin	1 - 300 ac-ft. (Detail cost shown in Alt. A excluding utility relocation, if any)	619,343	15	11	-	1	3	1,839,840
	Detention-"Wingate"	1 - 93 ac-ft.	©454,000						
	Embankment Removal	1 - 14,000 CY	140,228						
	Floodproofing	6 Indiv. 3' walls @ $7,000 each	42,000	6	6	-	-	-	419,371
			1,448,446	29	21	-	1	6	
					TOTAL ALTERNATIVE B				2,549,211

TABLE 12

BENEFIT-COST COMPARISON OF ALTERNATIVES

FOLLY BRANCH

(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sch.	Sheds	Value
									$
ALT. C	Alternative 1 with Wingate	Cost items detailed in Alt. A & B	1,634,446	33	21	-	1	11	2,464,597
			Δ454,000						
			•1,634,446	33	TOTAL ALTERNATIVE C				2,464,597
ALT. D	6' Tunnel	3 - 105' Long	846,875	7	4	-	-	3	290,000
	Detention-Regional	1 - 300 ac-ft.	619,343	14	11	-	-	3	767,680
	Detention-Wingate	1 - 93 ac-ft.	Δ454,000	0	-	-	-	-	
	Floodproofing	11 indiv. 3' wall	42,000	7	6	-	1	-	1,870,917
			•1,508,218		TOTAL ALTERNATIVE D				2,928,597

°Excluding Wingate
*Utility Relocation not included
ΔNot a public cost

TABLE 13

BENEFIT-COST COMPARISON OF ALTERNATIVES

BALD HILL BRANCH
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
ALT. A	Detention Basin 90 ac.-ft. capac.	Construction cost including 25% contingency & 15% eng. & overhead	$ 266,000	28	28			1,905,400
	Land cost	22 acres	110,500					
	* Utility Relocation							
	Relocation	One residence	73,500					
	Waterproofing	Two houses	14,000					
	Floodproofing	Nine houses	63,000					
			527,000		TOTAL ALTERNATIVE A			1,905,400
ALT. B	Tunneling	6' R.C.C. Pipe, 80 ft.	12,800	28	28			1,905,400
		Tunneling thru embankment, 80 ft.	80,000					
		Rip-rap, 70 sq. yd.	2,500					
		B-72' H.W. 2	7,000					
			102,300					
		25% contingency	25,600					
		15% eng. & overhead	19,200					
			147,100					
		Relocation of 14 houses	1,182,100					
		TOTAL ALTERNATIVE B	1,329,200		TOTAL ALTERNATIVE B			1,905,400

*Utility Relocation not included

TABLE 13

BENEFIT-COST COMPARISON OF ALTERNATIVES

BALD HILL BRANCH

(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid. Comm. Sheds	Value
			$			$
ALT. C	Detention Basin of 68 ac-ft. capacity	Construction cost inclu- 25% contingencies & 15% eng. & overhead	185,450	30	28 + 2 (due to detention)	2,054,800
	Land Value	20 acres	126,500			
*	Utility Cost Relocation	14 houses	1,169,950			
	Elvis Lane Improvement		175,400			
		TOTAL ALTERNATIVE C	1,657,300		TOTAL ALTERNATIVE C	2,054,800
ALT. D	Relocation	28 houses	2,381,700		TOTAL ALTERNATIVE D	1,905,400

*Utility Relocation not included

TABLE 14

BENEFIT-COST COMPARISON OF ALTERNATIVES

SOUTHWEST BRANCH
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
ALT. A	Walker Mill Park Site (440 ac-ft. design)	Construction cost including 25% contingencies	488,000	20	13	6	1	1,683,300
		15% eng. & overhead	73,200					
		Recreation Facilities Construction	36,500					
	* Utility Relocation							
			597,700					
	Harry Truman Dr. Site (400 ac-ft. design)	Construction cost including 25% contingencies	619,200					
		15% eng. & overhead	93,000					
	Land Costs	76 Floodplain acres @ $4,000/acre	304,000					
		6 Fringe @ $7,000/acre	42,000					
			1,655,900					
	Acqusition	7 Residences	513,800	7	7			513,800
	Relocation	25% of Market Value	128,500					
		TOTAL ALTERNATIVE A	2,298,200		TOTAL ALTERNATIVE A			2,197,100

*Utility Relocation not included

TABLE 14

BENEFIT-COST COMPARISON OF ALTERNATIVES

SOUTHWEST BRANCH
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
ALT. B	Walker Mill Park Site	Detailed in Alt. A	597,700	20	13	6	1	1,683,300
	Harry S. Truman Site	Detailed in Alt. A	1,058,200					
	Flood Wall	Wall; 5' Height, 200' Length (inclu. sump pump and valve)	7,000	1	1			40,400
	Floodproofing	6 residences @ $7,000 ea	42,000	6	6			473,400
		TOTAL ALTERNATIVE B	1,705,000		TOTAL ALTERNATIVE B			2,197,100
ALT. C	Walker Mill Park Site	Detailed in Alt. A	597,700	18	11	6	1	1,524,700
	Flood Wall	Detailed in Alt. B	7,000	1	1			40,400
	Floodproofing	8 residences @ $7,000 ea	56,000	8	8			632,000
		TOTAL ALTERNATIVE C	660,700		TOTAL ALTERNATIVE C			2,197,100

TABLE 14

BENEFIT-COST COMPARISON OF ALTERNATIVES

SOUTHWEST BRANCH
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
			$					$
ALT. D	Walker Mill Park Site	Detailed in Alt. A	597,700	20	13	6	1	1,683,300
	Harry S. Truman Site	Detailed in Alt. A	1,058,200					
	D'Arcy Road (Improvement 70 ac-ft. design)	Construction Cost including 25% contingencies	80,300					
		15% eng. & overhead	12,100					
	Land Cost	9 acres Floodplain @ $4,000/acre	36,000					
		7 acres Fringe @ $7,000/acre	49,000					
*	Utility Relocation							
	Floodwall	Wall, 5' height, 200' length (including sump pump and valve)	7,000	1	1			40,400
	Floodproofing	6 residences @ $7000/ea.	42,000	6	1			473,400
		TOTAL ALTERNATIVE D	1,882,300		TOTAL ALTERNATIVE D			2,197,100

*Utility Relocation not included

TABLE 15

BENEFIT-COST COMPARISON OF ALTERNATIVES

FEDERAL SPRING BRANCH
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
			$					$
ALT. A	Acquisition	6 Residences	262,500	12	6		6	
	Relocation	25% of Value	65,600					
		TOTAL ALTERNATIVE A	328,100		TOTAL ALTERNATIVE A			262,500
ALT. B	Detention Basin 2 (157ac-ft. capac.)	Construction cost including 25% contingency	6,700					
		15% eng. & overhead	1,000					
	Land Cost	10 acres Floodplain @ $4,000/acre	40,000					
		11 acres Fringe @ $7,000 acre	77,000					
	* Utility Relocation							
			124,700					
	Detention Basin 3 (87-ac-ft. capac.)	Construction cost including 25% contingency	94,900					
		15% eng. & overhead	14,200					

*Utility Relocation not included

TABLE 15

BENEFIT-COST COMPARISON OF ALTERNATIVES

FEDERAL SPRING BRANCH
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
			$					$
ALT. B (cont'd)	Land Cost	4 acres Floodplain @ $4,000/acre	16,000					
		7 acres Fringe @ $7,000/ acre	49,000					
	* Utility Relocation							
			174,100					
		Total of Detention Basins 2 & 3	298,800	4	3		1	152,200
	Acquisition	3 Residences	110,300					
	Relocation	25% of value	27,600					
			137,900	8	3		5	110,300
		TOTAL ALTERNATIVE B	436,700		TOTAL ALTERNATIVE B			262,500
		*Utility Relocation not included						

TABLE 15

BENEFIT-COST COMPARISON OF ALTERNATIVES

FEDERAL SPRING BRANCH
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
ALT. C	Detention Basin 2	Detailed in Alt. B	$ 124,700					$
	Detention Basin 3	Detailed in Alt. B	174,100					
			298,800					
	Detention Basin 4 (123 ac-ft. capac)	Construction cost including 25% contingency	263,400					
		15% eng. & overhead	39,500					
	Land Cost	14 acres Floodplain @ $4,000/acre	56,000					
		8 acres Fringe @ $7,000 acre	56,000					
	* Utility Relocation							
			414,900					
		Total of Detention Basins 2,3, & 4	713,700	6	5		1	222,600

TABLE 15

BENEFIT-COST COMPARISON OF ALTERNATIVES

FEDERAL SPRING BRANCH
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
ALT. C (cont'd)	Acquisition	1 Residence	39,900					
	Relocation	25% of value	10,000					
			49,900	6	1		5	39,900
		TOTAL ALTERNATIVE C	763,600		TOTAL ALTERNATIVE C			262,500
ALT. D	Detention Basin 2	Detailed in Alt. B	124,700					
	Detention Basin 3	Detailed in Alt. B	174,100					
	Detention Basin 4	Detailed in Alt. C**	408,100**					
			706,900					
	Detention Basin 1 (86 ac-ft. capac)	Construction cost including 25% contingency	220,800					
		15% eng. & overhead	33,100					

**Due to reduced inflow, a smaller pipe can be used, thus lower construction

TABLE 15

BENEFIT-COST COMPARISON OF ALTERNATIVES

FEDRAL SPRING BRANCH
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
			$					$
ALT. D (cont'd)	Land Cost	5 acres Floodplain @ $4,000/acre	20,000					
		8 acres Fringe @ $7,000/ acre	56,000					
	* Utility Relocation							
			329,900					
		Total of Detention Basins 1, 2, 3, & 4	1,036,800	6	5		1	222,600
	Acquisition	1 Residence	39,900					
		25% of value	10,000					
			49,900	6	1		5	39,900
		TOTAL ALTERNATIVE D	1,086,700		TOTAL ALTERNATIVE D			262,500

*Utility Relocation not included

TABLE 15

BENEFIT-COST COMPARISON OF ALTERNATIVES

FEDERAL SPRING BRANCH
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
ALT. E	Levee #1 (530' earthen, 5.5' high; 125' brick, 5' high)	Construction cost including 25% contingency	48,300					
		15% eng. & overhead	7,200					
*	Utility Relocation							
			55,500	9	4		5	148,200
	Acquisition	2 Residences	114,300					
	Relocation	25% of value	28,600					
			142,900	3	2		1	114,300
		TOTAL ALTERNATIVE E	198,400		TOTAL ALTERNATIVE E			262,500

*Utility Relocation not included

TABLE 16

BENEFIT-COST COMPARISON OF ALTERNATIVES

COLLINGTON BRANCH
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
ALT. A	Acquisition	6 Residences	72,500	6*	6			72,500**
	Relocation	25% of value	18,100					
	Floodproofing	5 Residences @ $7,000 ea	35,000	5	5			333,200
		TOTAL ALTERNATIVE A	125,600					405,700
ALT. B	Stormwater Management Facility (3,000 ac-ft. design)	Construction cost including 25% contingencies	446,200	5*	5			40,000**
		15% eng. & overhead	66,900					
	Land Cost	150 acre Floodplain @ $4,000/acre	600,000					
		85 acre Fringe @ $7,000/acre	595,000					
***	Utility Relocation							
	Floodproofing	6 Residences @ $7,000 ea	42,000	6	6			365,700
		TOTAL ALTERNATIVE B	1,750,100					405,700

*Entries include 4 residences with no current improvement value.
**Entries reflect only those residences with current improvement values.
***Utility Relocation not included

TABLE 17

BENEFIT-COST COMPARISON OF ALTERNATIVES

WESTERN BRANCH (MAIN STEM)
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
ALT. A	Watkins Park Det. Basin (2,553 ac-ft. storage capacity)	Construction cost including 25% contingencies & 15% eng. & overhead	$ 1,471,790	30		30		20,693,553
	Collington Det. Basin (4574 ac-ft. storage capacity)	Construction cost including 25% contingencies & 15% eng. & overhead	1,708,000	7	7			271,653
	Harry Truman Dr. Det. Basin on SW (400 ac-ft. storage capacity)	Construction cost including 25% contingencies & 15% eng. & overhead	1,058,110	12			12	
	* Utility Relocation							
		Total of 3 Detention Basins	4,237,900					
	Levee U/S of Rt. 301 on left bank	Approx. 4' tall, 1000' long, earthen embankment	28,755	3		3		4,620,400
	Levee U/S of Water Street on right bank around Court House comlex	Steel waterproof fence driven into top of existing levee and replacement of current waterproof fence with concrete fence	497,300	9		9		3,569,307
			4,763,955		TOTAL ALTERNATIVE A			29,154,913

*Utility Relocation not included

TABLE 17

BENEFIT-COST COMPARISON OF ALTERNATIVES

WESTERN BRANCH (MAIN STEM)
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
ALT. B	Watkins Park Det. Basin (2,553 ac-ft. storage capacity)	Construction cost including 25% contingencies & 15% eng. & overhead	1,471,790	30		30		20,693,553
	Collington Det. Basin (4574 ac-ft. storage capacity)	Construction cost including 25% contingencies & 15% eng. & overhead	1,708,000	7	7			271,653
	Harry Truman Dr. Det. Basin on SW (400 ac-ft. storage capacity)	Construction cost including 25% contingencies & 15% eng. & overhead	1,058,110	12			12	
*	Utility Relocation							
		Total of 3 Detention Basins	4,237,900					
	Levee U/S of Rt. 301 on left bank	Approx. 4' tall, 1000' long, earthen embankment	28,755	3		3		4,620,400
	Levee U/S of Water Street on right bank	Steel waterproof fence driven into top of existing levee and replacement of current waterproof fence with concrete fence	497,300	9		9		3,569,307

*Utility Relocation not included

TABLE 17

BENEFIT-COST COMPARISON OF ALTERNATIVES

WESTERN BRANCH (MAIN STEM)
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
ALT. B (cont'd)	Waterproofing of 11 of 12 remaining residential flooded structures	Concrete fencing for 11 of 12 structures, other structure depth of inundation is 75 feet	77,000	11	11			714,427
	Acquisition Relocation	1 Residence 25% of value	10,000 2,500	1	1			10,000
		TOTAL ALTERNATIVE B	4,853,455		TOTAL ALTERNATIVE B			29,879,340

TABLE 17

BENEFIT-COST COMPARISON OF ALTERNATIVES

WESTERN BRANCH (MAIN STEM)
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
ALT. C	Watkins Park Det. Basin (2,553 ac-ft. storage capacity)	Construction cost including 25% contingencies & 15% eng. & overhead	1,471,790	30		30		20,693,553
	Collington Det. Basin (4,574 ac-ft. storage capacity)	Construction cost including 25% contingencies & 15% eng. & overhead	1,708,000	7	7			271,653
	Harry Truman Dr. Det. Basin on SW (400 ac-ft. storage capacity)	Construction cost including 25% contingencies & 15% eng. & overhead	1,058,110	12			12	
	* Utility Relocation							
		Total of 3 Detention Basins	4,237,900					
	Levee U/S of Rt. 301 on left bank	Approx. 4' tall, 1000' long, earthen embankment	28,755	3		3		4,620,400

*Utility Relocation not included.

TABLE 17

BENEFIT-COST COMPARISON OF ALTERNATIVES

WESTERN BRANCH (MAIN STEM)
(Stream Name)

ALTERNATIVES	ELEMENTS	DESCRIPTION OF ELEMENTS	COST OF ELEMENTS	Type / Total	BENEFITS NUMBER OF STRUCTURES PROTECTED Resid.	Comm.	Sheds	Value
ALT. C (cont'd	Levee U/S of Water Street on right bank	Steel waterproof fence driven into top of existing levee and replacement of current waterproof fence with concrete fence	497,300	9		9		3,569,307
	Acquisition	12 Residences	442,773	12	12			442,773
	Relocation	25% of value	110,693					
		TOTAL ALTERNATIVE C	5,317,421			TOTAL ALTERNATIVE C		29,597,686

11.0 THE RECOMMENDED PLAN

The recommended management plan for controlling flood damage in the Western Branch Watershed consists of:

- o Rezoning the Folly Branch Sub-watershed Upstream of the Conrail Railroad Crossing

The comprehensive rezoning map that was approved by the Council in April 1980 shows approximately 91 percent of the area zoned as residential, 7 percent as industrial, and 2 percent as commercial. At full development, this zoning plan would result in the ground covering of approximately 40 percent of the area with impervious surfaces, such as concrete, asphalt, roads, etc. and increase runoff volumes by over 20 percent, over existing condition. This area of the sub-watershed has severe flooding, erosion, and sedimentation problems, that would be significantly exacerbated if development were to proceed as zoned. The stream opening under the Conrail railroad crossing is recommended for enlargement from 72 square feet to approximately 144 square feet to relieve the back water effects at the crossing. Future development as zoned would result in a larger opening being required to relieve this back water effect than the recommended approximate 144 square foot opening. An opening that is larger than the recommended 144 square foot opening would require the shoring, bracing and securing of the embankment material and cost approximately $500,000 more. It is therefore recommended that this part of the subwatershed be rezoned to categories of lower density and intensity to minimize stormwater runoff, and the pollution of the stream from erosion and sedimentation. A large lot development district (10-acre, 15- or 25-acre lots) in this area should be considered.

- o Increasing the size of the culvert opening under the Conrail Railroad crossing over Folly Branch

The existing railroad culvert is a 72 square foot arch brick tunnel. It is partially silted and has an effective opening of 64 square feet. The top of the embankment over the culvert is approximately 40 feet high at elevation 154 mean sea level. The culvert would convey a 100 year flood flow at an elevation of 133 feet with a substantial back water effect due to the relative small size of the culvert and this would cause the flooding of homes upstream. Enlarging the size of the opening to approximately 144 square feet would cause the back water effect to drop to elevation 126 feet (MSL) and substantially reduce the flooding potential upstream. The cost of this operation is estimated at $650,000.

- o Construction of a 300 acre-foot dry detention basin upstream of the Lincoln Subdivision on Folly Branch

The Lincoln Subdivision is presently prone to flooding due to channel overflow. Future development upstream and the enlargement of the Conrail railroad crossing would significantly increase the rate and volume of flood flows in the channel within the area. To control the magnitude and level of flows in the channel during flood events, this detention basin is proposed. The detention basin would require approximately 90 acres of land, of which 67.5 acres is in the flood plain. The 100 year pool elevation would be at 122 feet mean sea level. The dam would be earth-fill and have twin 84-inch reinforced concrete pipes as principal spillway. The cost estimate for constructing detention basin is $620,000. This estimate, however, does not include the cost of relocating any utilities in the area.

- o Removal of the abandoned Route 704 Embankment

This embankment across Folly Branch was part of an old railroad track from Seat Pleasant to Baltimore. When the track was abandoned by the railroad Company, the State Department of Highway acquired the right-of-way for the possible conversion of a dirt road that runs along the embankment to Route 704 extended. The conversion program has since been abandoned, however the embankment remains in place. This earth-fill embankment causes the flooding of structures upstream by constricting flood flows and creating significant backwater effects. The removal of this impediment to flow is recommended. The cost of its removal is approximately $140,000.

- o Construction of a 90-acre foot dry detention basin on Bald Hill Branch approximately 1,100 feet upstream of Good Luck Road

The flooding problems identified on Bald Hill Branch occur downstream of the site of this proposed basin, due to stream overflow and flood plain encroachment. Construction of this basin would control the rate of flow in the area and directly alleviate the flooding of 17 homes. The depth of flooding on 10 homes would be reduced significantly to permit flood-proofing to function as an effective flood mitigation measure. One house would still be flooded to a depth of over 3 feet and as such is recommended for acquisition, and relocation. The detention basin would have a surface area of 22 acres, 14.5 acres of which is flood plain land. The embankment would be 16 feet high and of earth material. Two 60-inch Class IV reinforced concrete pipes of 120-foot lengths would serve as principal spillways and a 100-foot concrete weir would provide emergency overflow capability. The approximate cost of this facility is $400,000. This however, does not include the cost of relocating any utilities in the area.

- o Construction of a multi-purpose pond on Southwest Branch with a storage capacity of 440 acre-feet in Walker Mill Park

The drainage area to this site is 2.83 square miles with an estimated future 100-year discharge of 4,400 cfs. This rate of discharge

would cause significant stream overflow downstream. To control flood flows, the proposed pond would have 60 acres of surface area, with a normal pool depth of 5 to 6 feet. The embankment would be 650 feet long and 33 feet high. Such a proposed pond would reduce the future 100-year flood flow from 4,400 cfs to 700 cfs. The approximate cost of this facility not including the relocation of utilities in the area is $600,000.

- o Construction of a 400 acre-foot dry pond approximately 4,500 feet upstream of Harry S. Truman Drive crossing on Southwest Branch

A 400 acre-foot dry pond approximately 4,500 feet upstream of Harry S Truman Drive is proposed. The pond's embankment would be approximately 21 feet high and 1,300 feet long and require approximately 40,000 cubic yards of fill material. The basin would reduce the future 100 year flow from 7,000 cfs to 5,500 cfs and it cost is estimated at 1.7 million dollars.

- o Construction of a 3,000 acre-foot dry pond on Collington Branch downstream of Leeland Road

This 3,000 acre-foot detention basin with a 25 foot high embankment would be designed to drain completely after a storm event. This basin would reduce significantly the flood flows in the lower reaches of Collington Branch resulting in the viability of flood proofing as a mitigation measure for structures downstream still prone to flooding. Reduction in both the magnitude and level of flood flows along the main stem of Western Branch below its confluence with Collington Branch would also occur due to this basin. The estimated cost of this proposed facility is 1.7 million dollars.

- o Construction of a multi-purpose pond in the vicinity of Watkins Regional Park

This basin is proposed within the Watkins Regional Park, owned and operated by the Parks and Recreation Department of M-NCPPC. The basin would provide substantial storage for flood waters during flood events and reduce flows in the stream segment within the Town of Upper Marlboro. Given its park setting, recreational features should be added to this facility to increase its usefulness and attractiveness to the Parks and Recreation Department. It is therefore proposed as a multi-purpose facility, with a surface area of 200 acres. The embankment would be of earth material with an elevation of 75 feet (MSL). Discharge through the embankment would be controlled by four 84 inch reinforced concrete pipes with a release rate of 4,150 cfs for the 100-year flood with emergency spillway provided by a concrete weir. This would be approximately 4,000 cfs less than the computed future 100 year flood flow. The estimated cost of this structure is 1.5 million dollars.

- o Construction of a levee system along the Western Branch main stem between Route 301 southbound and Conrail

On the basis of this study, the Marlboro Shopping Center is flood prone to a depth of 4 feet. To protect the Center, an earth fill levee at an estimated cost of $30,000. The levee would be approximately 1,000 feet long with an average height of 4 feet. The construction of such a levee would not cause a significant rise in the water surface elevation, (a maximum rise of less than 0.2 foot is estimated).

- o Upgrading and raising the height of the existing levee - water proof fence system extending upstream from Water Street

This system was designed in 1964 by the U.S. Army Corps of Engineers, and extends for a distance of approximately 1,800 feet upstream of Water Street. It was designed with a top elevation of 23 feet (MSL). Owing to settlement of the fill material and other factors, the top elevation of the system is now 21 feet and its height is not adequate to contain the future 100 year flood level computed as 24.4 feet (elevation with proposed flood management measures installed upstream.) To protect the County Court House Complex and the Board of Education Office buildings adjacent to it, the existing system is proposed for upgrading and raising to an elevation of 26 feet (MSL). The existing metal water proof fencing is proposed for replacement with a taller concrete fence. The estimated cost of upgrading the existing system is $500,000.

- o Construction of a levee system along Federal Spring Branch

The levee is proposed on the south side of Old Marlboro Pike between Brown Station Road and the Marlboro Country Club driveway. The levee would have an average height of approximately 5.5 feet and approximate length of 530 feet. It is estimated to cost $56,000.

- o Acquisition of five residential structures in the flood plain

A residential structure, 3508 Ritchie-Marlboro Road, is located wholly within the Cabin Branch flood plain. The house has a first floor elevation of 90.0 feet (MSL) whereas the 100 year flood elevation is 93.8 feet. This house is located in close proximity to existing Ritchie Marlboro right-of-way so future roadway improvements along this segment of Ritchie Marlboro would require purchase of this house. The estimated value of the house is $24,000. Acquisition and relocation of this house is recommended as the most cost effective flood mitigation measure and is estimated at $30,000. A house on 9227 4th Street, Seabrook, within Bald Hill Branch Sub-watershed is subject to inundation up to a 3 feet depth Its close proximity to the bank of the stream precludes the application of other mitigation measures. Acquisition and relocation of this structure is also recommended. The estimated cost of acquisition is $74,000.

One residential structure along the main stem, would be inundated to a depth of 5 feet even with the proposed upstream management schemes in place. This structure, 15108 Marlboro Pike, in Upper Marlboro is recommended for acquisition and relocation at an approximate cost of $12,500.

Two residential structures on Old Marlboro Pike, 13011 and 13013, within Federal Spring Branch Sub-watershed are in close proximity to the bank of the stream. First floor living spaces would be inundated up to a 5 foot depth. Acquisition and relocation of these two structures is recommended, at an approximate cost of $143,000.

o Flood proofing of residential structures

Individual flood proofing is proposed for the following residential structures which are listed by water course.

Water Course	Structure Location
Folly Branch	10800 Lanham Severn Road Lanham
	10706 Potomac Street Glenn Dale
	10708 Potomac Street Glenn Dale
	6507 Woodstream Drive Glenn Dale
Bald Hill Branch	9305 Lanham-Severn Road Seabrook
	6110 C Street Seabrook
	9214 6th Street Seabrook
	9212 6th Street Seabrook
	9203 Wellington Court Seabrook
	9219 3rd Street Seabrook
	9216 3rd Street Seabrook
	9201 Wellington Court Seabrook

Water Course	Structure Location
Bald Hill Branch (cont.)	9111 Wellington Place Seabrook
	6818 Cipriano Road) Water- 6900 Cipriano Road) proofing of base- ment
Southwest Branch	2017 Marbury Drive District Heights
	1504 Shady Glen Drive District Heights
	1514 Ritchie Road District Heights (individual levee)
	11104 Webbwood Court Upper Marlboro
	11114 Webbwood Court Upper Marlboro
	11302 Sherrington Court Upper Marlboro
	11304 Sherrington Court Upper Marlboro
Turkey Branch	3130 Pyles Drive Upper Marlboro
	3131 Pyles Drive Upper Marlboro
	3133 Pyles Drive Upper Marlboro
	2600 Ritchie-Marlboro Road Upper Marlboro
Collington Branch	15728 Pointer Ridge Road Bowie
	15730 Pointer Ridge Drive Bowie

Water Course	Structure Location
Collington Branch (cont.)	15732 Pointer Ridge Drive Bowie
	15734 Pointer Ridge Drive Bowie
	15117 Peerless Avenue Upper Marlboro
	15119 Peerless Avenue Upper Marlboro
Western Branch (Main Stem)	12002 Hunterton Street Upper Marlboro
	11900 Chesterton Drive Upper Marlboro
	14946 Main Street Upper Marlboro
	14948 Main Street Upper Marlboro
	15105 Marlboro Pike Upper Marlboro
	15106 Marlboro Pike Upper Marlboro
	15220 Route 725 Upper Marlboro
	15228 Marlboro Pike Upper Marlboro
	15226 Marlboro Pike Upper Marlboro
	15242 Marlboro Pike Upper Marlboro
	15100 Peerless Avenue Upper Marlboro

- o A request to Maryland State Highway Administration to correct the ponding around the intersection of Route 301 and Chrysler Drive

This intersection is subject to inundation to a depth of 4 feet from a 100 year flood event. Flooding of the intersection would be due to the overflow of the Depot pond with flow along Chrysler Drive which is 4 feet lower than adjacent elevation. It is recommended that the State Highway Administration be advised of this problem which could be solved by any of several measures including:

(a) Raising the grade level of Chrysler Drive to approximately 26 feet elevation (MSL) which would be compatible with the elevation of the surrounding area.

(b) Placing a water proof barrier with a 26 feet top elevation along Chrysler Drive for a distance of approximately 450 feet.

- o Owners of flood prone structures should be notified and informed about flood insurance. Under the provisions of the Flood Disaster Protection Act of 1973, the Federal Flood Insurance Program provides coverage for all types of buildings, whether owned publicly or privately and regardless of profit or nonprofit, religious, residential, industrial, commercial or agricultural use.

- o The County through regulations, should greatly restrict or prohibit land use activities that would aggravate existing flood hazard or precipitate new ones. Adopted and approved land use and control measures should be reviewed and where necessary revamped with effective enforcement provisions.

The effectiveness of the recommended management plan for controlling flood damage in the watershed is detailed in Tables 18 and 19. The tables show that all flood prone residential structures would be protected from flood damage now and in the future if and when the plan is implemented. 37 of the 91 garages/sheds, 35 of the 79 commercial structures, and the one school identified as flood prone based on future development plans, would also be protected from flood damage.

The essential structural components of the recommended plan is shown in Figure 3.

Recommended Plan for erosion and sedimentation control.

- To minimize erosion and sedimentation in the watershed, the County in conjunction with the State Highway Administration should initiate an annual clean-up and clean-out program for culverts and bridge waterways throughout the County.

- Immediate action should be initiated to correct the erosion problems identified in the report.

- Existing regulations, ordinances and codes directed toward sediment control should be vigorously enforced.

- A survey of agricultural enterprises should be conducted to identify poorly managed sites. Once identified, remedial measures should be taken.

- Features preventing the introduction of runoff from impervious surfaces directly into receiving waters should be incorporated into storm water management plans.

- Sensitive site planning which retains natural drainageways, minimizes impervious surfaces, retains trees and vegetation cover, maximizes the distance between development activities and drainageways and maximizes the soil's infiltration capacity, should be encouraged.

TABLE 18

EFFECTIVENESS OF PROPOSED MANAGEMENT PLAN

(EXISTING LAND USE CONDITION)

TYPE OF STRUCTURE / REAM URSE	RESIDENTIAL			GARAGES/SHEDS			COMMERCIAL			SCHOOLS			RECREATIONAL		
	Original Total Flood Prone	No. Re-moved	No. Still In	Original Total Flood Prone	No. Re-moved	No. Still In	Original Total Flood Prone	No. Re-moved	No. Still In	Original Total Flood Prone	No. Re-moved	No. Still In	Original Total Flood Prone	No. Re-moved	No. Still In.
OLLY	10	10	-	9	2	7	4	-	4	1	1	-	-	-	-
OTTSFORD	-	-	-	3	-	3	-	-	-	-	-	-	-	-	-
ALD HILL	17	17	-	14	6	8	-	-	-	-	-	-	-	-	-
ORTHEAST	-	-	-	7	-	7	1	1	-	-	-	-	-	-	-
OUTHWEST	6	6	-	16	9	7	10	8	2	-	-	-	2	-	2
URKEY	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-
ABIN	1	1	-	3	-	3	-	-	-	-	-	-	-	-	-
ACK	-	-	-	2	-	2	-	-	-	-	-	-	-	-	-
EDERAL SPRG.	5	5	-	6	5	1	2	-	2	-	-	-	-	-	-
OLLINGTON	8	8	-	2	2	-	-	-	-	-	-	-	-	-	-
ESTERN MAIN STEM)	19	19	-	28	13	15	62	36	26	-	-	-	-	-	-
TOTAL	66	66	-	91	37	54	79	45	34	1	1	-	2	-	2

TABLE 19

EFFECTIVENESS OF PROPOSED MANAGEMENT PLAN

(FUTURE LAND USE CONDITION)

TYPE OF STRUCTURE / STREAM COURSE	RESIDENTIAL			GARAGES/SHEDS			COMMERCIAL			SCHOOLS			RECREATIONAL		
	Original Total Flood Prone	No. Removed	No. Still In	Original Total Flood Prone	No. Removed	No. Still In	Original Total Flood Prone	No. Removed	No. Still In	Original Total Flood Prone	No. Removed	No. Still In	Original Total Flood Prone	No. Removed	No. Still In.
FOLLY	21	21	-	20	18	2	4	-	4	1	1	-	-	-	-
LOTTSFORD	-	-	-	8	-	8	-	-	-	-	-	-	-	-	-
BALD HILL	28	28	-	14	1	13	-	-	-	-	-	-	2	-	2
NORTHEAST	-	-	-	7	-	7	1	1	-	-	-	-	-	-	-
SOUTHWEST	20	20	-	16	15	1	12	6	6	-	-	-	2	-	2
TURKEY	4	4	-	1	-	1	-	-	-	-	-	-	-	-	-
CABIN	1	1	-	4	-	4	-	-	-	-	-	-	-	-	-
BACK	-	-	-	3	-	3	-	-	-	-	-	-	-	-	-
FEDERAL SPRG.	6	6	-	6	5	1	2	-	2	-	-	-	-	-	-
COLLINGTON	11	11	-	4	-	4	1	-	1	-	-	-	-	-	-
WESTERN (MAIN STEM)	19	19	-	31	12	19	70	42	28	-	-	-	-	-	-
TOTAL	110	110	-	114	51	63	90	49	41	1	1	-	4	-	4

12.0 DESIGN AND CONSTRUCTION SEQUENCE

The recommended plan involves the design and construction of several mitigation facilities in addition to flood proofing and acquisition of individual structures. This plan when fully implemented would significantly reduce flow levels and prevent flood damages in the watershed. The management measures proposed on the tributaries are integrals of the overall plan to ameliorate flooding at the Town of Upper Marlboro.

The design and construction of all the elements of the plan at the same time is probably not feasible, due to financial and technical constraints. It is therefore deemed necessary to prescribe a design and construction priority. This schedule based on a number of factors including the number of existing and future flood prone structures, their assessed value, and the total estimated cost of the management plan is offered as a recommendation to the implementing agencies.

As shown in Table 20, Bald Hill Branch has the largest number of flood prone structures based on both existing and future development. The assessed value of the residential structures is approximately $1.5 million dollars. The cost of the management plan for this sub-watershed is approximately $0.5 million dollars. If the protection of flood-prone structures is termed the significant benefits of the management plan, the benefit/cost ratio of the Bald Hill measure is 1:0.32. Turkey and Cabin Branches have higher benefit cost ratios. However, there are no major design and construction activities involved in the implementation of their management plans and have a small number of structures within the floodplain. They could therefore be implemented concurrently with Bald Hill.

Although the Folly Branch measure does not have a benefit cost ratio as attractive as Southwest, Collington, or Federal Spring Branch, it is recommended for implementation next to Bald Hill on the basis of the number of flood prone structures within its sub-watershed and the overall flow reduction effectiveness of the proposed management measure. Southwest Branch is recommended for implementation ahead of Collington on the basis of the same argument.

Western Branch (main stem) management plan is recommended for implementation as the last leg of the overall plan although it contains 19 flood prone structures. It does not have an attractive benefit cost ratio and is an integration of some of the sub-watershed management plans. Therefore, as the priority schedule is implemented, partial realization of the main stem management plan will result.

TABLE 20

RECOMMENDED DESIGN AND CONSTRUCTION SCHEDULE
(IN DESCENDING PRIORITY)

	No. Res. struct. flooded by 100-yr.-Future	Value of Res. struct. removed from 100-year Floodplain	Cost of Mgmt. Scheme	Flow Reduction	Cost of Mgmt.÷ Value of Residences removed	Cost of Mgmt.÷ No. of struct. removed-Future	No. Res. flooded by 100-year-Present
WATERCOURSE:							
BALD HILL	28	$1,905,400 [28]	$ 520,000	D.S. of Basin 30%	.27	$ 18,571	17
FOLLY	21	$1,441,679 [21]	$1,634,446	D.S. of Basin 51%	1.13	$ 77,830	10
SOUTHWEST	20	$2,197,100 [20]	$ 647,000(1)	D.S. of Basin 50%	.29	$ 32,350	6
COLLINGTON	7(2)	$ 405,700(2) [7]	$ 125,600(3)(4)	0(5)	.31	$ 17,943	4(2)
FEDERAL SP.	6	$ 262,500 [6]	$ 198,400	0	.76	$ 33,067	5
WESTERN	19	$ 714,430 [19]	$4,853,455	At Upper Marlboro 36%	6.79	$255,455	19
TURKEY	4	$ 208,775 [4]	$ 28,000	0	.13	$ 7,000	0
CABIN	1	$ 24,000 [1]	$ 24,000	0	1.0	$ 24,000	1

See Footnotes on following page.

FOOTNOTES:

(1) Does not include the cost of the "Truman" detention basin which benefits Upper Marlboro.
(2) Does not include 4 houses which are shceduled to be razed.
(3) Does not include the cost of the regional detention basin which benefits Upper Marlboro.
(4) If regional detention basin is built, this portion of the management cost would be $42,000 for the floodproofing of 6 residences.
(5) Does not reflect detention basin; reflected in Western Branch figure.

[6] Number of residential structures valued.

13.0 APPENDIX A - TABLES

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APPENDIX "C"

HYDROLOGIC AND HYDRAULIC INFORMATION
(With Management)

FOLLY BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Lanham Severn Road Second Crossing (51.0)	101*	284*	530*	737*	199	487	848	1118
	131.5+	132.1+	132.7+	133.0+	131.9	132.6	133.2	133.6
Confluence w/ Trib 3	156	456	894	1259	436	996	1696	2222
(47.0)	125.0	126.9	128.4	129.2	126.9	128.8	130.1	131.1
Glen Dale Road	156	456	894	1259	436	996	1696	2222
(45)	124.9	126.8	128.3	129.1	126.8	128.7	129.9	131.0
Lanham Severn Road First Crossing (40.0)	224	647	1242.	1745	683	1499	2471	3207
	124.0	126.0	127.2	127.5	126.0	127.4	128.0	129.3
Conrail	234	677	1297	1822	724	1583	2600	3376
(35.0)	120.7	121.8	123.1	125.3	121.9	123.6	126.2	128.8
Confluence w/ Trib 2	167	526	976	1348	380	896	1487	1971
(28.0)	118.0	118.8	119.5	121.8	118.5	119.2	121.7	120.5
Confluence w/ Trib 1	226	651	993	1336	427	872	1286	1958
(26.1)	112.4	116.1	119.3	121.5	112.5	114.2	121.4	116.2
Baltimore Lane	233	709	1135	1478	432	930	1363	1980
(22.0)	110.9	112.7	113.5	114.0	111.6	113.2	113.8	114.7
Old R.R. Embankment	233	709	1135	1478	432	930	1363	1980
(19.0)	110.7	111.8	112.8	113.4	111.2	112.4	113.2	114.2
Route 450	233	709	1135	1478	432	930	1363	1980
(15.0)	108.7	110.8	112.0	112.6	109.6	111.7	112.3	113.5
Palmer Highway	233	709	1135	1478	432	930	1363	1980
(12.0)	108.6	110.1	111.3	112.1	109.2	110.7	111.8	113.3
John Hanson Highway	233	709	1135	1478	432	930	1363	1980
(7.0)	104.5	106.3	107.3	107.9	105.4	106.8	107.7	108.8

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(With Management)

FOLLY BRANCH TRIBUTARIES

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
TRIB 2	53*	147*	262*	355*	75	211	375	508
Lanham Severn Road (61.0)	134.6 +	135.8+	136.3+	136.6+	134.8	136.1	136.6	137.0
Conrail	53	147	262	355	75	211	375	508
(58.0)	130.2	132.7	134.2	135.5	130.7	132.9	135.1	136.6
TRIB 3	86	263	480	657	225	534	888	1165
Conrail (103.1)	132.1	134.3	134.9	136.4	133.6	134.9	137.0	138.8
Lanham Severn Road	62	113	125	133	94	121	131	139
(103.6)	125.1	126.9	128.5	129.3	126.9	128.8	130.2	131.2

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(With Management)

APPENDIX C

LOTTSFORD BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
@Confluence w/ Tributary 1 (132.1)	124 *	394 *	748*	1038 *	201	551	976	1318
	125.7 +	127.1+	128.3 +	128.9 +	125.9	127.6	128.7	129.3
Route 450	125	396	746	1041	196	538	953	1285
(1034.0)	123.8	126.5	127.6	128.1	124.9	126.9	128.0	128.4
Route 193	178	577	1103	1541	340	882	1527	2044
(1036.0)	112.9	114.9	117.0	118.9	113.6	116.0	118.7	120.6
Route 50	178	577	1103	1541	340	882	1527	2044
(1036.3)	112.6	114.8	116.9	118.8	113.4	116.0	118.6	120.5
Chantilly Lane	197	585	1096	1552	339	843	1472	1905
(1038.10)	105.6	107.3	108.6	109.8	106.3	108.0	109.6	110.6
@Confluence w/	269	850	1660	2390	481	1241	2251	3171
Folly (1040.0)	93.7	95.2	96.7	97.1	93.8	96.1	97.1	97.7
Lottsford Vista Road	269	850	1660	2390	481	1241	2251	3171
(1041.3)	90.5	92.5	93.5	94.1	91.3	93.0	93.9	94.6

* Stated recurrence interval discharge in cfs at location.
+ Stated recurrence interval elevation in feet mean sea level at location.

APPENDIX C

HYDROLOGIC AND HYDRAULIC INFORMATION
(With Management)
BALD HILL BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Ardmore- Ardwick Rd.	359*	981*	1600 *	2073 *	510	1151	1773	2249
(1071.0)	96.9 +	98.5 +	99.2 +	99.5 +	97.3	98.9	99.4	99.6
Route 50	377	975	1563	2011	526	1131	1727	2180
(1062.0)	109.0	111.5	113.7	115.4	109.7	112.1	114.3	116.0
George Palmer Highway	426	1041	1645	2096	592	1243	1902	2391
(1061.0)	110.0	112.5	115.2	117.9	110.7	113.2	116.3	118.5
Alcona Street	394	1051	1688	2135	547	1295	2036	2547
(1057.0)	116.5	118.2	119.7	120.2	117.0	118.7	120.3	120.9
Route 450	333	712	1169	1456	496	818	1262	1569
(1054.0)	120.6	121.8	122.9	123.5	121.2	122.1	123.2	123.9
Greenwood Lane	321	646	872	1037	483	757	984	1151
(1053.0)	122.7	124.6	125.4	126.0	123.9	125.0	125.8	126.3
Conrail	327	692	1190	1571	513	909	1357	1776
(1052.0)	129.2	132.4	134.6	136.2	130.9	133.5	135.8	137.4
Lanham-Severn Road	316	656	985	1282	485	831	1284	1633
(1051.0)	129.1	132.5	135.0	136.4	130.9	133.8	136.0	137.3
4th Street	310	643	912	1179	474	800	1149	1425
(1050.0)	131.3	133.5	135.5	136.7	132.2	134.7	136.3	137.8
Tuckerman Lane	289	582	773	884	453	720	889	1087
(1048.0)	135.1	136.2	137.0	137.6	135.7	136.7	137.5	138.4
Good Luck Road	282	567	754	861	444	695	854	1063
(1047.0)	135.8	137.1	137.9	138.3	136.6	137.6	138.3	139.1
Brae Brooke Drive	108	242	406	533	192	396	615	779
(1043.1)	152.7	154.1	154.1	154.3	153.5	154.0	154.5	154.

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location

APPENDIX C

HYDROLOGIC AND HYDRAULIC INFORMATION
(With Management)

NORTHEAST BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Confluence w/ Western Branch NED 010-119.	601*	1635*	3154*	4504*	828	2112	4003	5665
	69.7+	72.8+	74.6+	76.2+	70.9	73.5	75.6	77.7
At Central Avenue	496	1434	2793	4001	674	1893	3581	5085
NEO-045-1117.2	73.3	77.0	78.4	79.1	74.1	77.7	78.9	79.4
Enterprise Road	496	1434	2793	4001	674	1893	3581	5085
NEO-060-11701	74.3	78.2	80.3	81.2	75.1	79.1	80.9	81.8
Confluence-Tributary B	496	1434	2793	4001	674	1893	3581	5085
NEO-11701	74.3	78.2	80.3	81.2	75.1	79.1	80.9	81.8
Woodmore Road	69	202	351	431	95	257	463	668
NEO-126-1097.2	96.4	98.5	99.8	100.5	97.2	99.2	100.7	101.8
John Hanson Highway	209	669	1264	1756	381	1048	1866	2501
NEO 195-9201	119.2	123.2	127.5	129.7	120.8	126.4	129.8	130.4
Confluence Tributary D	209	669	1264	1756	381	1048	1866	2501
NEO 195-9201	119.2	123.2	127.5	129.7	120.8	126.4	129.8	130.4
Study Limit	60	201	385	537	122	342	611	828
NEO-220-108801.	137.5	138.9	139.9	140.3	137.5	139.7	140.5	141.0

TRIB B	378	1143	2193	3095	527	1531	2824	396(
Confluence w/ main NEO-010-1116	76.0	79.0	80.9	81.9	76.7	79.8	81.6	82.6
Confluence Trib C	378	1143	2193	3095	527	1531	2824	396(
NEB 030-11501.00	88.4	90.6	91.2	91.6	89.3	90.9	91.5	92.0
Woodmore Road	188	589	1120	1562	272	807	1434	199
NEB 095-110602.	110.9	114.2	115.1	115.5	111.8	114.7	115.4	115.

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(With Management)

SOUTHWEST BRANCH & TRIBUTARIES

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Kipling Parkway	297	709	1186	1588	340	815	1384	1828
(2009.0)	199.4	203.1	205.3	205.9	199.9	203.6	205.6	206.2
Walker Mill Road @ Confluence w/ Ritchie Branch (2018.1)	409	613	686	857	437	628	696	1022
	142.4	143.7	144.5	145.2	142.8	144.2	145.2	146.2
Ritchie Road	775	1504	2338	2994	964	1884	2877	3790
(2030.1)	125.4	126.9	126.9	127.4	125.8	126.5	127.3	128.7
Confluence w/ Tributary #3 (2031.1)	775	1504	2338	2994	964	1884	2877	3790
	122.6	124.0	124.6	124.7	123.0	124.6	124.7	124.9
Hampton Boulevard	835	1650	2622	3298	1027	2096	3147	3833
(2035.1)	114.3	116.4	119.7	121.8	115.0	117.7	121.5	122.2
Interstate 95 @Confluence w/ Tributary #2 (38.3)	920	1995	3475	4425	1350	3060	4544	5358
	107.8	109.5	111.5	111.5	108.7	111.0	111.1	112.0
Harry S. Truman Drive	1390	2430	4583	6192	1966	3695	6272	7035
(2064.0)	81.4	83.3	86.3	87.1	82.6	85.7	87.2	87.4
Confluence w/ Tributary 1 (67.1)	1542	3040	4982	6682	2221	3918	6545	7533
	68.4	68.7	69.9	70.9	68.0	69.3	70.9	71.4
White House Road	1542	3040	4982	6682	2221	3918	6545	7533
(2074.1)	58.8	60.2	61.4	62.3	59.5	60.8	62.2	62.5

TRIBUTARIES

Ritchie Branch

D'arcy Road	210	422	732	1064	356	766	1531	2197
(202305.0)	181.5	183.0	185.2	186.8	183.7	186.0	188.0	188
Ritchie Forestville Road	326	705	1245	1734	485	1121	1858	257(
(202501.0)	158.7	161.0	161.4	161.7	160.5	161.2	161.8	162

HYDROLOGIC AND HYDRAULIC INFORMATION
(With Management)

SOUTHWEST BRANCH & TRIBUTARIES (Continued)

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
	SOUTHWEST BRANCH Tributary 1							
Unnamed Road #4	84 *	303 *	545*	720 *	215	507	777	1033
(206902.0)	118.1 +	119.2 +	119.9 +	120.2 +	118.9	119.8	120.2	120.6
Unnamed Road #3	84	303	545	720	215	507	777	1033
(2069.0)	105.7	106.9	107.7	108.2	106.5	107.6	108.3	108.9
Unnamed Road #2	84	303	545	720	215	507	777	1033
(2069.4)	91.5	94.4	95.2	95.7	94.0	95.1	95.9	96.5
Unnamed Road #1	84	303	545	720	215	507	777	1033
(2070.1)	83.1	85.0	86.1	86.6	84.1	85.7	86.6	87.2
White House Road	164	510	860	1145	319	709	1164	1569
(2071.3)	72.9	74.3	75.3	76.5	73.6	74.9	76.5	78.0
Woodlawn Boulevard	164	510	860	1145	319	709	1164	1569
(2071.6)	68.8	70.7	73.0	73.3	69.3	72.5	73.3	73.3
	TRIBUTARIES							
	Southwest Branch Tributary 2							
Unnamed Road	138	455	865	1180	331	868	1447	1877
(2040.0)	122.5	123.1	123.7	124.0	122.9	123.7	124.5	126.3
Central Avenue (Rt. 214)	158	541	1046	1439	425	1106	1846	2397
(2042.0)	115.3	117.9	120.7	122.5	117.1	120.7	123.6	125.9

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION APPENDIX C
(With Management)
SOUTHWEST BRANCH & TRIBUTARIES (Continued)

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
	TRIBUTARIES							
	Southwest Branch Tributary 3							
Ritchie Road	116 *	400 *	559 *	754*	307	684	1100	1420
(203402.0)	125.8+	129.8+	130.2 +	130.5+	129.9	130.5	131.0	131.3

* Stated recurrence interval discharge in cfs at location.
+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(With Management)

APPENDIX C

TURKEY BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Brown Station Road	112*	415*	862*	1269*	285	879	1657	2321
(2089.0)	69.4+	72.7+	76.4+	78.7+	71.4	76.5	79.9	80.1
Old Railroad Grade	112	415	862	1269	285	879	1657	2321
(2088.0)	81.2	83.0	84.6	85.7	82.4	84.7	86.6	88.0
Ritchie-Marlboro Road	43	209	463	727	156	454	945	1390
(2085.0)	106.8	109.4	111.5	112.7	108.8	111.5	112.2	112.9

* Stated recurrence interval discharge in cfs at location.
+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(With Management)

CABIN BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Brown Station Rd.; Confluence w/ Back Branch (3018.1)	817*	2723*	4888*	6572*	1829	4107	6789	8951
	33.0+	35.8+	36.8+	37.3+	35.0	36.5	37.4	38.0
Old Railroad Grade	595	1921	3423	4596	1420	3040	4997	6558
(3016.0)	61.3	65.1	67.8	69.4	64.4	67.2	69.8	71.5
Ritchie-Marlboro Road	595	1921	3423	4596	1420	3040	4997	6558
(3014.0)	87.7	91.6	94.3	95.3	90.4	93.9	95.5	96.3

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION APPENDIX C
(With Management)

BACK BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Old Railroad Grade	222 *	800*	1454*	1903*	431	1135	1814	2414
(3026.2)	59.8+	63.2+	65.1+	66.1+	61.1	64.1	65.9	67.0
Ritchie-Marlboro Road	204	712	1331	1867	423	1093	1908	2529
(3024.0)	102.5	106.4	108.8	109.9	104.4	108.8	110.0	110.7
Roblee Drive	75	368	807	1155	360	853	1508	1960
(3021.0)	131.9	133.8	135.6	136.9	133.8	135.8	138.0	138.8

* Stated recurrence interval discharge in cfs at location.
+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION APPENDIX C
(With Management)

FEDERAL SPRING & TRIBUTARIES

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Federal Spring @Confluence w/ Tributary B (43.05)	95 * 78.0 +	395 * 80.5 +	870 * 83.7 +	1280 * 86.1+	285 84.8	925 84.0	1690 88.2	2260 90.8
@Confluence w/ Tributary C (343.3)	109 69.0	482 70.0	1081 72.2	1616 73.3	365 69.6	1226 72.5	2180 74.1	2874 74.9
Ritchie-Marlboro Rd. @Confluence w/ Tributary A (343.5)	236 58.6	837 63.0	1732 67.6	2509 71.0	523 61.0	1691 67.0	2934 71.3	3692 72.6
Old Marlboro Pike (3048.5)	267 31.2	932 34.8	1673 36.1	2127 36.7	547 33.0	1515 36.0	2201 36.8	2985 37.5
Tributary A Old Marlboro Pike (3046.0)	144 65.7	421 67.4	768 69.9	1048 71.3	191 65.4	600 69.2	1102 71.6	1504 72.9
Tributary C Marlboro Pike (30420.)	11 72.7	84 74.9	213 76.8	334 78.2	97 75.5	328 78.1	628 83.6	877 90.1
Tributary B Marlboro Pike (3041.1)	39 81.0	178 85.1	406 85.2	621 87.0	145 85.0	433 85.3	848 88.8	1197 91.4

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(With Management)

APPENDIX C

COLLINGTON BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Confluence w/ Western	386 *	873 *	1538 *	2195 *	537	1203	2182	3236
CB 5	18.7 +	22.4 +	24.8 +	26.4 +	19.9	23.6	25.6	27.6
Largo Road (Rt. 202)	386	873	1538	2195	537	1203	2182	3236
CB 6	18.7	22.4	24.8	26.5	19.9	23.6	25.7	27.7
East Branch	372	843	1160	1770	518	962	1491	3191
CB 17	28.9	29.8	30.3	31.1	29.3	30.0	30.8	32.6
Tributary 1	727	2239	4312	6130	494	3172	5670	7611
CB 29	46.0	47.9	51.5	55.7	45.2	48.8	53.8	56.4
Black Branch	599	1896	3686	5249	1114	2775	4890	6509
CB 35	56.8	59.1	60.9	62.2	57.9	60.04	61.9	63.0
Leeland Road South	599	1896	3686	5249	1114	2775	4890	6509
CB 32	51.7	53.4	55.0	57.1	52.6	54.2	56.1	57.7
Leeland Road North	599	1896	3686	5249	1114	2775	4890	6509
CB 36	57.2	61.5	65.0	67.3	59.1	63.4	66.8	68.8
Central Avenue (Rt. 214)	295	915	1974	2989	420	1214	2613	3728
CB 50	74.1	77.1	80.0	82.3	74.8	78.1	81.5	84.6
Hall Road	295	915	1974	2989	420	1214	2613	3728
CB 52	74.9	78.4	80.7	82.6	75.8	79.2	81.9	84.7
Mount Oak Road	259	812	1669	2433	481	1374	2569	3585
CB 164	95.3	98.3	101.9	102.2	96.1	100.5	102.2	103.3
John Hanson Highway Rt. 50	179	571	1158	1612	276	807	1439	1932
CB 77	114.1	116.8	118.0	119.2	114.8	116.9	118.8	119.9
Annapolis Road Rt. 450	10	37	79	136	21	64	127	246
CB 86	140.7	141.6	143.3	144.8	141.0	142.6	144.7	147.0

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(With Management)

COLLINGTON BRANCH continued

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Church Road at Collington CB 89	70 *	229*	445*	626*	130	380	695	953
	135.6+	136.5 +	137.1+	137.5+	136.1	137.7	137.9	140.6
Church Road at Black Branch 413	133	476	961	1373	340	976	1638	2168
	72.8	77.0	80.2	81.2	75.5	80.2	81.6	82.5

*Stated recurrence interval discharge in cfs at location.
+Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(With Management)

APPENDIX C

MAIN STEM WESTERN BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Lottsford Road	620	1890	3410	4710	990	2390	3970	5760
(1074.1)	87.3	88.0	88.8	89.3	87.4	88.3	89.0	89.8
Central Avenue	620	1890	3410	4720	990	2400	4150	5780
(1086.0)	69.3	72.6	74.4	76.2	70.6	73.3	75.4	77.2
Confluence w/	1030	3140	6150	8770	1490	4200	7800	10950
Northeast (200201)	68.9	72.1	74.1	75.9	70.1	73.0	75.2	77.0
Route 202	1130	2580	3850	5235	1600	3050	4180	6500
(2008.0)	54.0	56.1	57.9	59.4	54.6	56.8	58.5	60.0
Confluence w/	2700	5200	8400	10800	3700	6650	10150	12000
Southwest (2076.0)	52.2	52.9	53.9	54.7	52.4	53.4	54.4	55.0
Confluence w/	2700	5400	8700	11150	3700	6800	10300	12400
Turkey (2080.0)	41.8	43.2	44.7	45.7	42.2	43.9	45.3	46.1
Confluence w/	2700	5850	9500	12200	3800	5850	11000	13800
Cabin (302901)	28.3	30.3	32.5	34.0	28.8	31.2	33.3	34.7
Confluence w/ (3036.0)	2700	5850	9500	12200	3800	7200	11000	13800
Federal Spring	19.3	22.6	25.1	27.1	20.4	23.8	25.9	28.0
Main Street; Confluence w/	3000	6700	10700	13700	4100	8200	12350	16400
Collington (3052.1)	18.6	22.0	24.1	26.8	19.7	23.1	25.5	27.7
Water Street	3000	6700	10700	13700	4100	8200	12350	16400
(3054.0)	17.7	20.8	23.6	25.2	18.7	21.8	24.4	26.7
Route 4	3000	6700	10700	13700	4100	8200	12350	16400
(3055.0)	16.2	19.6	22.2	23.9	17.5	20.6	23.2	25.4
Conrail	3000	6700	10700	13700	4100	8200	12350	16400
(3056.1)	14.5	17.3	20.0	21.8	14.7	16.4	18.7	20.9
Route 301	3000	6700	10700	13700	4100	8200	12350	16400
(3057.5)	13.1	14.8	17.3	18.9	14.3	15.7	18.2	20.5

APPENDIX C

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

FOLLY BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Lanham Severn Road Second Crossing (51.0)	101 *	284*	530*	737*	200	487	848	1165
	131.5+	132.1+	132.6+	133.1+	131.9	132.6	133.6	134.3
Confluence w/ Trib 3	156	456	894	1259	436	996	1696	2222
(47.0)	125.3	127.5	130.2	132.2	127.2	129.9	133.1	133.8
Glen Dale Road	156	456	894	1259	436	996	1696	2222
(45)	125.2	127.5	130.1	132.2	127.2	129.9	133.1	133.7
Lanham Severn Road First Crossing (40.0)	224	647	1242	1745	685	1500	2471	3207
	124.9	127.1	129.9	132.0	126.6	129.4	132.8	133.4
Conrail	234	677	1297	1822	724	1583	2604	3375
(35.0)	124.2	127.0	129.8	131.9	125.9	129.3	132.7	133.2
Confluence w/ Trib 2	130	380	695	977	267	620	1028	1190
(28.0)	117.8	118.6	119.0	119.3	118.3	118.9	119.3	121.0
Confluence w/ Trib 1	251	758	1444	2017	453	1190	2091	2848
(26.1)	111.9	114.4	116.5	118.3	113.5	115.8	118.6	120.6
Baltimore Lane	343	1087	2099	2944	765	1958	3394	4547
(22.0)	110.9	113.4	115.6	117.6	112.6	114.6	117.8	120.0
Old R.R. Embankment	193	661	1366	1970	349	1065	1998	2740
(19.0)	110.7	112.8	115.5	117.5	111.5	114.4	117.6	119.8
Route 450	198	671	1365	1961	354	1042	1919	2611
(15.0)	108.6	110.7	112.3	113.4	109.2	111.6	113.4	114.2
Palmer Highway	198	671	1365	1961	354	1042	1919	2611
(12.0)	108.5	110.0	111.8	113.2	108.9	111.0	113.1	114
John Hanson Highway	205	659	1343	1945	351	1004	1858	2514
(7.0)	104.4	106.1	107.7	108.7	105.1	107.0	108.6	109.

* Stated recurrence interval discharge in cfs at location.

\+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

FOLLY BRANCH TRIBUTARIES

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Lanham Severn Road	53 *	147 *	262 *	355 *	75	210	375	508
(61.0)	134.6 +	135.8 +	136.3 +	136.6 +	134.8	136.1	136.6	137.0
Conrail	53	147	262	355	75	210	375	508
(58.0)	130.3	132.7	134.2	135.5	130.7	132.9	135.1	136.6
TRIBUTARY 3 Conrail	86	263	480	657	224	534	888	1165
(103.1)	132.1	134.3	136.6	139.2	133.5	135.9	139.9	141.4
Lanham Severn Road	62	113	126	133	94	121	131	139
(103.6)	125.6	127.6	130.2	132.2	127.3	130.0	133.1	133.8

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

APPENDIX C

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

Lottsford Branch

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Confluence w/	125*	396*	746*	1041*	196	538	953	1285
Tributary 1 (132.1)	125.7+	127.1+	128.3+	128.9+	125.9	127.6	128.7	129.3
Route 450	125	396	746	1041	196	538	953	1285
(1034.0)	123.8	126.5	127.6	128.9	124.9	126.9	128.0	128.4
Route 193	178	577	1103	1541	340	882	1527	2044
(1036.0)	112.9	114.9	117.0	118.9	113.6	116.0	118.7	120.6
Route 50	178	577	1103	1541	340	882	1527	2044
(1036.3)	112.6	114.8	116.9	118.8	113.4	116.0	118.6	120.5
Chantilly Lane	197	585	1096	1552	339	843	1472	1905
(1038.10)	105.6	107.3	108.6	109.8	106.3	108.0	109.6	110.6
Confluence w/	258	854	1791	2734	446	1248	2510	3604
Folly (1040.0)	93.7	95.2	96.8	97.3	93.8	96.1	97.2	98.2
Lottsford Vista Road	258	854	1791	2734	446	1248	2510	3604
(1041.3)	90.5	92.6	93.6	94.3	91.3	93.1	94.0	94.8

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

APPENDIX C

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

BALD HILL BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Ardmore-Ardwick Rd.	372 *	1027 *	1705 *	2156 *	529	1226	1859	2292
(1071.0)	96.9 +	98.6 +	99.3 +	99.6 +	97.4	99.1	99.4	99.7
Route 50	390	1029	1671	2083	553	1225	1810	2217
(1062.0)	109.1	111.7	114.1	115.6	109.8	112.5	114.6	116.2
George Palmer Highway	461	1100	1712	2141	661	1329	1932	2395
(1061.0)	110.2	112.7	115.7	118.1	110.9	113.6	116.6	118.5
Alcona Street	440	1104	1707	2129	644	1347	2012	2523
(1057.0)	116.7	118.3	119.7	120.2	117.2	118.8	120.2	120.8
Route 450	375	783	1198	1468	583	964	1274	1555
(1054.0)	120.8	122.0	123.0	123.5	121.5	122.5	123.2	123.8
Greenwood Lane	363	741	1116	1233	570	932	1201	1327
(1053.0)	123.3	125.0	126.3	126.6	124.3	125.7	126.5	126.9
Conrail	382	921	1513	1868	636	1369	1949	2283
(1052.0)	129.6	133.3	137.1	138.2	131.7	135.3	137.9	139.1
Lanham-Severn Road	365	881	1452	1804	604	1294	1839	2152
(1051.0)	129.6	133.6	137.2	138.3	131.8	135.6	138.0	139.2
4th Street	365	881	1452	1804	604	1294	1839	2152
(1050.0)	131.5	134.7	137.4	138.5	133.0	136.1	138.2	139.4
Tuckerman Lane	340	822	1361	1702	574	1224	1752	2049
(1048.0)	135.3	136.8	138.3	139.5	136.1	137.7	139.3	140.5
Good Luck Road	340	822	1361	1702	574	1224	1752	2049
(1047.0)	136.1	138.1	140.0	141.5	137.1	139.6	141.6	142.6
Brae Brooke Drive	108	242	406	533	192	396	615	779
(1043.1)	152.7	154.1	154.1	154.3	153.5	154.0	154.5	154.7

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

APPENDIX C

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

NORTHEAST BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Confluence w/ Western Branch NED 010-119	794 * 70.3 +	2249 * 73.2 +	4333 * 75.2 +	6178 * 77.0 +	828 70.8	2112 73.5	4003 75.3	5665 77.0
At Central Avenue NEO-045-1117.2	698 74.2	2096 77.9	4059 79.1	5769 79.7	 74.1	 77.7	3581 78.9	5085 79.4
Enterprise Road NEO-060-11701	698 75.3	2096 79.5	4059 81.3	5769 82.2	674 75.1	1893 79.1	3581 80.9	5085 81.8
Confluence - Tributary B NEO-11701	698 75.3	2096 79.5	4059 81.3	5769 82.2	674 75.1	1893 79.1	3581 80.9	5085 81.8
Woodmore Road NEO-126-1097.2	253 98.7	856 102.5	1703 105.7	2419 106.7	95 97.2	257 99.2	463 100.7	668 101.8
John Hanson Highway NEO 195-9201	209 119.3	669 123.2	1264 127.5	1756 129.7	381 120.8	1048 126.4	1866 129.8	2501 130.4
Confluence Tributary D NEO 195-9201	209 119.3	669 123.2	1264 127.5	1756 129.7	381 120.8	1048 126.4	1866 129.8	2501 130.4
Study Limit NEO-220-108801	60 137.5	201 138.9	385 139.9	537 140.3	122 137.5	342 139.7	611 140.5	828 141.0
TRIB B Confluence w/ main . NEO-010-1116	378 76.6	1143 80.0	2193 81.9	3095 82.9	527 76.7	1531 79.8	2824 81.6	3960 82.6
Confluence Trib C NEB 030-11501.00	378 88.5	1143 90.6	2193 90.7	3095 91.0	527 89.3	1531 90.9	2824 91.5	3960 92.0
Woodmore Road NEB 095-110602.	188 110.9	589 114.2	1120 115.1	1562 115.5	272 111.8	807 114.7	1434 115.4	1994 115.9

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

APPENDIX C

SOUTHWEST BRANCH & TRIBUTARIES

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Kipling Parkway (2009.0)	297 199.4	709 203.1	1186 205.3	1588 205.9	340 199.9	815 203.6	1385 205.8	1828 206.2
Walker Mill Road Confluence w/ Ritchie Branch (2018.1)	885 143.7	2132 145.9	3622 147.7	4806 147.7	1068 144.3	2485 146.8	4160 147.5	5480 148.4
Ritchie Road (2030.1)	1081 126.1	2713 127.2	4748 129.3	6412 130.0	1396 126.7	3350 128.4	5705 129.7	7670 130.7
Confluence w/ Tributary (2031.1)	1081 123.2	2713 124.6	4748 125.3	6412 125.8	1396 123.8	3350 124.9	5705 125.6	7670 126.2
Hampton Boulevard (2035.1)	1145 115.3	2796 120.4	4377 122.5	6051 123.1	1455 116.0	3190 121.7	5265 122.8	7256 123.5
INTERSTATE 95 Confluence w/ Tributary #2 (38.3)	1236 108.3	3057 111.0	4781 111.3	6854 114.5	1568 109.0	3390 111.4	5720 112.3	8339 117.7
Harry S. Truman Dr. (2064.0)	1634 81.9	4037 85.9	6594 87.3	9359 88.2	2283 83.1	5034 86.6	8597 87.9	11878 88.8
Confluence w/ Tributary 1 (67.1)	1728 68.7	4224 69.6	6894 71.1	9684 72.0	2405 68.1	5253 70.1	8765 71.8	12010 72.6
White House Road (2074.1)	1728 59.0	4224 61.0	6894 62.3	9684 63.2	2405 59.6	5253 61.6	8765 62.9	12010 63.8

T R I B U T A R I E S

Ritchie Branch								
D'arcy Road (202305.0)	267 183.1	521 184.4	906 186.0	1326 187.1	356 183.7	766 186.0	1531 188.0	2197 188.1
Ritchie Forestville Road (202601.0)	326 158.7	705 161.0	1246 161.4	1734 161.7	485 160.5	1122 161.2	1859 161.8	2570 162.2

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

SOUTHWEST BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
	SOUTHWEST BRANCH Tributary 1							
Unnamed Road #4	84*	303*	545*	720*	215	507	777	1033
(206902.0)	118.1+	119.2+	119.9+	120.2+	118.9	119.8	120.2	120.6
Unnamed Road #3	84	303	545	720	215	507	777	1033
(2069.0)	105.7	106.9	107.7	108.2	106.5	107.6	108.3	108.9
Unnamed Road #2	84	303	545	720	215	507	777	1033
(2069.4)	91.5	94.4	95.2	95.7	94.0	95.1	95.9	96.5
Unnamed Road #1	84	303	545	720	215	507	777	1033
(2070.1)	83.1	85.0	86.1	86.6	84.1	85.7	86.6	87.2
White House Road	164	510	860	1146	319	710	1164	1569
(2071.3)	72.9	74.3	75.5	76.5	73.6	74.9	76.5	78.0
Woodlawn Boulevard	164	510	860	1146	319	710	1164	1569
(2071.6)	69.1	71.7	73.2	73.6	69.4	72.9	73.5	73.9

TRIBUTARIES

	SOUTHWEST BRANCH Tributary 2							
Unnamed Road	138	455	865	1180	332	868	1447	1877
(2040.0)	122.5	123.1	123.7	124.0	122.9	123.7	124.5	126.2
Central Ave. (Rt. 214)	158	541	1046	1440	425	1105	1846	2397
(2042.0)	115.3	117.9	120.7	122.4	117.2	120.7	123.6	125.8

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

(SOUTHWEST BRANCH cont.'d)

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
	SOUTHWEST BRANCH Tributary 3							
Ritchie Road (203402.0)	116*	317*	559*	754*	307	684	1100	1421
	127.3+	130.0+	130.5+	130.9+	129.8	130.6	131.1	131.4

* Stated recurrence interval discharge in cfs at location.
+ Stated recurrence interval elevation in feet mean sea level at location.

APPENDIX C

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

TURKEY BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Brown Station Road	112*	415*	862*	1269*	285	879	1657	2321
(2089.0)	69.4+	72.7+	76.4+	78.7+	71.4	76.5	79.9	80.1
Old Railroad Grade	112	415	862	1269	285	879	1657	2321
(2088.0)	81.1	83.0	84.6	85.7	82.4	84.7	86.6	88.0
Ritchie-Marlboro Road	43	209	463	727	156	454	945	1390
(2085.0)	106.8	109.4	111.5	112.7	108.8	111.5	112.2	112.9

* Stated recurrence interval discharge in cfs at location.
+ Stated recurrence interval elevation in feet mean sea level at location.

APPENDIX C

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

CABIN BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Brown Station Rd.; Confluence w/ Back Branch (3018.1)	817 * 33.1+	2723* 35.8+	4888* 36.8+	6572* 38.1+	1829 35.0	4107 36.5	6789 37.4	8951 39.0
Old Railroad Grade (3016.0)	595 61.3	1921 65.1	3423 67.8	4596 69.4	1420 64.4	3040 67.2	4997 69.8	6558 71.5
Ritchie-Marlboro Road (3014.0)	595 87.7	1921 91.6	3423 94.3	4596 95.3	1420 90.4	3040 93.9	4997 95.5	6558 96.3

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

BACK BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Old Railroad Grade	222*	800*	1454*	1903*	431	1135	1814	2414
(3026.2)	59.8+	63.2+	65.1+	66.1+	61.1	64.1	65.9	67.3
Ritchie-Marlboro Road	204	712	1331	1867	423	1093	1908	2529
(3024.0)	102.5	106.4	108.8	109.9	104.4	108.8	110.0	110.7
Roblee Drive	75	368	807	1155	360	853	1508	1960
(3021.0)	131.9	133.8	135.6	136.9	133.8	135.8	138.0	138.8

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

APPENDIX
FEDERAL SPRING & TRIBUTARIES

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Federal Spring @Confluence w/ Tributary B (43.05)	95* 78.0+	395* 80.5+	870* 83.7+	1280* 86.1+	285 84.8	925 84.8	1690 88.2	2260 90.8
@Confluence w/ Tributary C (343.3)	109 69.0	482 70.0	1081 72.2	1616 73.3	365 69.6	1226 72.5	2180 74.1	2874 74.9
Ritchie-Marlboro Rd., @Confluence w/ Tributary A (343.5)	236 58.6	837 63.0	1732 67.6	2509 71.0	523 61.0	1691 67.0	2934 71.3	3692 72.6
Old Marlboro Pike (3048.5)	267 31.2	932 35.0	1673 36.1	2127 36.6	547 33.0	1515 36.0	2201 36.8	2985 37.4
Tributary A Old Marlboro Pike (3046.0)	144 65.7	421 67.4	768 69.9	1048 71.3	191 65.4	600 69.2	1102 71.6	1504 72.9
Tributary C Marlboro Pike (30420)	11 72.7	84 74.9	213 76.8	334 78.2	97 75.5	328 78.1	628 83.6	877 90.1
Tributary B Marlboro Pike (3041.1)	39 81.0	178 85.1	406 85.2	621 87.0	145 85.0	433 85.3	848 88.8	1197 91.4

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

APPENDIX C

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

COLLINGTON BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Confluence w/ Western CB 5d	641 *	1988*	4009 *	5879 *	1028	2730	5162	7023
	19.0 +	24.3 +	28.2 +	31.8 +	20.2	25.1	29.7	33.2
Largo Road (Rt. 202)	641	1988	4009	5879	1028	2730	5162	7023
CB 6	19.0	24.3	28.4	32.0	20.2	25.2	29.9	33.4
East Branch	641	1988	4009	5879	1028	2730	5162	7023
CB 17	29.4	31.4	33.3	35.3	30.1	32.1	34.4	36.4
Tributary 1	590	1878	3814	5598	965	2625	4961	6734
CB 29	45.5	47.6	49.1	50.1	46.4	48.2	49.8	50.8
Black Branch	589	1835	3596	5143	1075	2647	4710	6278
CB 35	56.8	59.0	60.8	62.1	57.9	59.9	61.7	62.8
Leeland Road North	589	1835	3596	5143	1075	2647	4710	6278
CB 36	57.2	61.2	64.8	67.1	58.9	63.1	66.5	68.6
Central Avenue (Rt. 214)	295	915	1974	2989	420	1214	2613	3728
CB 50	74.1	77.1	80.0	82.3	74.8	78.1	81.5	84.6
Hall Road	295	915	1974	2989	420	1214	2613	3728
CB 52	74.9	78.4	80.7	82.6	75.8	79.2	81.9	84.7
Mount Oak Road	259	812	1669	2433	481	1374	2569	3585
CB 164	95.3	98.3	101.9	102.2	96.1	100.5	102.2	103.3
John Hanson Highway Rt. 50	179	571	1158	1612	276	807	1439	1932
CB 77	114.1	116.8	118.0	119.2	114.8	116.9	118.8	119.9
Annapolis Road Rt. 450	10	37	79	136	21	64	127	246
CB 86	140.7	141.6	143.3	144.8	141.0	142.6	144.7	147.0
Church Road at Collington	70	229	445	626	130	380	695	953
CB 89	135.6	136.5	137.1	137.5	136.1	137.7	137.9	140.6

* Stated recurrence interval discharge in cfs at location.
\+ Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

COLLINGTON BRANCH (cont.'d)

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Church Road at Black Branch 413	133*	476*	961*	1373*	340	976	1638	2168
	72.8+	77.0+	80.2+	81.2+	75.5	80.2	81.6	82.5
Leeland Road South CB 32	589	1835	3596	5143	1075	2647	4710	6278
	51.7	53.4	54.9	56.0	52.6	54.2	55.7	56.7

*Stated recurrence interval discharge in cfs at location.
+Stated recurrence interval elevation in feet mean sea level at location.

HYDROLOGIC AND HYDRAULIC INFORMATION
(Without Management)

MAIN STEM WESTERN BRANCH

LOCATION	PRESENT LAND USE				FUTURE LAND USE			
WATERCOURSE LOC.	2	10	100	500	2	10	100	500
Lottsford Road	630	1905	3630	5065	930	2510	4400	5900
(1074.1)	87.3	88.0	88.9	89.5	87.3	88.4	89.2	89.8
Central Avenue	655	1975	3755	5245	985	2630	4615	6200
(1086.0)	69.8	73.0	75.0	76.8	70.5	73.3	75.2	76.9
Confluence w/	1195	3725	7310	10540	1450	4130	7700	10730
Northeast (2002Q1)	69.4	72.6	74.7	76.6	70.0	72.9	74.8	76.6
Route 202	1220	3800	7435	10675	1500	4200	7800	10900
(2008.0)	54.4	57.9	60.3	61.0	54.8	58.5	60.4	61.0
Confluence w/	2780	7500	14000	19900	3700	9050	16000	22150
Southwest (2076.0)	52.2	53.6	55.7	57.4	52.5	54.1	56.3	58.0
Confluence w/	2780	7500	14000	19900	3700	9050	16000	22150
Turkey (2080.0)	41.9	44.2	46.7	48.5	42.4	44.9	47.3	49.1
Confluence w/	2780	7500	14000	19900	3700	9050	16000	22150
Cabin (302901)	28.3	31.4	34.9	37.6	28.9	32.3	35.9	38.7
Confluence w/ (3036.0)	2780	7500	14000	19900	3700	9050	16000	22150
Federal Spring	19.5	24.5	28.4	31.9	20.6	25.3	29.9	33.3
Main Street, Confluence	3090	8810	17070	24550	4240	10850	20080	27675
w/ Collington (3052.1)	18.9	23.8	28.1	31.7	19.9	24.3	29.6	33.1
Water Street	3090	8810	17070	24550	4240	10850	20080	27675
(3054.0)	18.0	22.5	27.4	31.1	18.9	23.8	29.0	32.5
Route 4	3090	8810	17070	24550	4240	10850	20080	27675
(3055.0)	16.5	21.1	25.9	29.7	17.6	22.4	27.4	31.2
Conrail	3090	8810	17070	24550	4240	10850	20080	27675
(3056.1)	14.8	18.9	23.7	27.4	15.4	20.2	25.3	28.8
Route 301	3090	8810	17070	24550	4240	10850	20080	27675
(3057.5)	13.3	16.3	21.0	22.5	12.5	17.5	21.7	23.0