Restoring a Bay Resource:

Riparian Forest Buffer Demonstration Sites

Forestry Workgroup
Nutrient Subcommittee
Chesapeake Bay Program

January 1997

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Chesapeake Bay Program

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BACKGROUND

Riparian forests are integral to the health of the Chesapeake Bay and its rivers for many reasons. Their position in the landscape makes riparian forests excellent buffers between upland areas and the adjacent waters that will eventually enter the Bay. Riparian forest buffers are capable of filtering ground and surface water, stabilizing streambanks, providing shade and supporting a variety of habitats.

Water Quality

Riparian forest buffers help maintain and improve water quality by preventing substantial amounts of sediment, nutrients (such as nitrogen and phosphorous) and toxics from reaching streams, rivers and the Chesapeake Bay. Excess nitrogen and phosphorous are two of the biggest threats to the health and productivity of the Bay. If allowed to reach the waterways, nitrogen and phosphorous promote algal growth, which upsets the balance of aquatic vegetation. When the algae die and decompose, they consume large quantities of oxygen, depleting the supply available for fish and other forms of aquatic life. Forested buffers can retain and absorb up to 80 percent of the phosphorous and 89 percent of the nitrogen in ground and surface water. The roots of buffer vegetation also create breaches in the soil which allow rainwater to penetrate, recharging underground aquifers.

Streambank Stabilization

A woodland floor is composed of multiple layers of dead and decaying leaves, branches, twigs and other organic matter. This forest "litter" acts like a sponge, retaining and absorbing large quantities of surface runoff. This allows the water to percolate into the soil slowly, rather than running off rapidly and carrying substantial quantities of topsoil with it. In fact, a mature forest floor can absorb up to six inches of rainfall per hour. Much of this runoff also contains nutrients, which, as discussed above, are absorbed and utilized by plants in the buffers to maintain their health and vigor. In addition, forested steam buffers benefit streambanks by physically binding their soil, which keeps the banks in place.

Wildlife Habitat

Wildlife habitat is greatly enhanced by riparian forest buffers through their provision of food, water, cover and nesting for a multitude of birds and small animals. Forest buffers also create an excellent protective corridor, which allows for freer movement of wildlife. In addition, these "Greenways" provide excellent scenic routes of travel for humans to use and énjoy.

Aquatic Habitat

Aquatic life in the streams and rivers benefits from riparian forest buffers. The trees' canopy shades the water, which moderates water temperatures and protects against rapid fluctuations that can harm aquatic organisms and reduce fish spawning and survival. The roots of the forest buffer, in addition to stabilizing the streambanks, provide numerous underwater obstacles which make excellent feeding grounds for fish. Also, leaves from the trees fall into the stream and are trapped on woody debris and rocks where they provide food and shelter for small bottom dwelling creatures, such as insects, amphibians, crustaceans and small fish, which are critical to the aquatic food chain.

IMPORTANCE OF DEMONSTRATION SITES

"Seeing is believing." This saying is especially true when it comes to communicating land management practices. Landowners and managers are interested in seeing the results of a conservation practice or a change in their management operations. Although providing educational and training opportunities and technical guides and manuals is valuable, seeing a project first hand is invaluable.

The restoration of riparian forests and natural approaches to stream restoration are relatively new practices. Although we have been planting trees for nearly a century, the use of hardwoods, the preparation and maintenance of planted sites, and the dynamic interaction with a river or stream are all characteristics of riparian restoration that we still are working to perfect and understand.

The riparian forest buffers in this document are located in agricultural, rural and urban settings. An effort was made to locate restoration efforts in all three of these settings in order to show the buffers' applicability in different land uses. Several of the profiled restoration sites were included in this document because of the size of the riparian forest buffer planting. The minimal buffer width for effective removal of pollutants and trapping of sediment is generally considered to be between 50'-75'. However, in several of the restoration sites, the buffer width exceeds this figure by 2-3 fold. Two of the buffer sites were specifically planted as part of a nature trail that is designed to highlight the functions and values of riparian forest buffers to visitors. Finally, some of the profiled sites are part of a larger watershed forest buffer planting, meaning that the restoration effort consisted of planting contiguous woody vegetation along a stream, rather than at one isolated location.

The use of ***demonstration sites*** for riparian forest buffer establishment is one way to help accomplish the objectives of communication, education, and monitoring. A demonstration site is a completed project that 1) is representative of other similar sites, 2) facilitates access by those who wish to observe or study project techniques, and 3) has monitoring which will help provide additional information to improve the practice over time. This compilation is a start. We will continue to add to this riparian forest buffer demonstration site guide over time.

ADELPHI MANOR PARK, MD

Background

Adelphi Manor Park is located along Route 193 in College Park, Maryland. The Northwest Branch of the Anacostia River runs through Adelphi Manor Park. The many smaller tributaries of the Anacostia's two principal branches, Northwest and Northeast, form a broad, fan-shaped drainage basin of 170 square miles. Due to the increased urbanization that has occurred in this watershed, the Anacostia River and many of its tributaries have become severely degraded. Specifically, the area's increasing imperviousness has resulted in stormwater flows with greater velocity, volume and pollutant levels.

Anacostia River Land Use Statistics

Urban	**44%**
Wooded	**29%**
Pasture	**15%**
Cultivated	**8%**
Surface mines; sand & gravel operations; construction sites	**4%**

Adelphi Manor Park is part of the Maryland National Capital Park and Planning Commission trail system. Therefore, along with stabilized streambanks and improved water quality, this riparian forest buffer will also provide aesthetic values for the trail users. The restoration effort is being coordinated by the Maryland Department of Natural Resources Forest Service, with funding from the U.S. Environmental Protection Agency.

Project Description

On April 29, 1995, the first phase of the Adelphi Manor Park Restoration Effort was initiated. Volunteers from the Chesapeake Bay Foundation, Metropolitan Washington Council of Governments, University of Maryland and Americorps planted one acre, or 500 linear feet, of forest buffer along one side of the Northwest Branch. The average width of the riparian forest buffer is 150'. Four hundred and fifteen containerized trees and seedlings of the following species were planted: red maple, green ash, black gum, red osier dogwood, arrowood viburnum, sweetbay magnolia, pin oak, yellow poplar, red oak, sycamore and serviceberry. On October 15, 1995, another 500 linear feet of buffer was planted with the help of the Chesapeake Bay Foundation and students from the University of Maryland.

In the Spring of 1996, the other side of the Northwest branch was planted. Using the same species as in the earlier plantings, approximately 600 linear feet of buffer, with an average width of 50' was restored. A stream clean-up was conducted in the spring of 1996 as well. In all, the Adelphi Manor Park project has resulted in the restoration of five acres, or ½ mile, of streambank. Because the Northwest Branch was experiencing erosion problems, over 100 dormant black willow stakes, which are effective streambank stabilizers, were driven into the bank to prevent further erosion. The Black Willow Stake Project will be used to determine if this practice is effective in stabilizing streambanks in the Anacostia watershed. The Adelphi Manor Park Restoration is an ongoing project.

Monitoring

The restoration effort at the Adelphi Manor Park will be monitored by MD Department of Natural Resources Forest Service personnel. Periodic examinations will be made to determine the tree survival and willow stake effectiveness. However, the tree survival rate will not be assessed.

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BEAVERDAM CREEK, MD

Background

Beaverdam Creek is one of the many Anacostia River tributaries that flow through the Beltsville Agricultural Research Center (BARC). Nearly half of the tributaries in the Anacostia watershed pass through BARC property. Restoration in this area provides an excellent opportunity to improve the water quality and overall health of the Anacostia River. Encompassing 6,582 acres, BARC represents almost 9 percent of the land in the Maryland section of the Anacostia watershed. This is one of the largest land holdings under single ownership in the watershed, and with proper management BARC can have a major impact on the condition of the Anacostia watershed and the people who live there.

As part of the restoration effort at BARC, twenty sites have been selected for reforestation. The first stage of the BARC restoration has been establishing riparian forest buffer plantings on a tributary of Beaverdam Creek. Before the restoration, the site was sparsely buffered on both sides with cedar, maple and sweetgum. This restoration site is adjacent to a wetland of special state concern, which provides habitat for a variety of wildlife, including neo-tropical migrant birds. Increasing the riparian forest buffer will provide additional habitat and diversity for wildlife and enhance the filtering capacity of this wetland area.

The establishment of riparian forest buffers at BARC is being funded through a grant from the U.S. Environmental Protection Agency and the USDA Forest Service. The grant provides support for reforestation projects throughout the Anacostia watershed and is administered by the MD Department of Natural Resources Forest Service.

During the past 20 years, an average of 100 acres of forest have been lost daily in the Chesapeake Bay watershed

Project Description

In the spring of 1995, a contractor hand planted 15 acres of riparian forest buffer. In all, 9,000 seedlings of the following varieties were planted: green ash, sycamore, black cherry, black walnut, crab apple, pin oak and red osier dogwood. The riparian forest buffer is roughly 100' wide on one side of the stream and slightly less on the other side. These Beaverdam Creek plantings have resulted in the establishment of 4,000 linear feet of riparian forest buffer. Due to the

significant deer population, deer fencing and tubex were used to protect the seedlings. These two methods of protecting tree seedlings will be monitored by MD Department of Natural Resources Forest Service for their effectiveness.

Monitoring

All planting sites will be checked to insure planting success. Survival counts will be taken for several years following reforestation. This will provide information not only on initial planting success but also on what other factors may impact reforestation attempts on agricultural land (e.g. rodents, herbicides, deer, machinery, etc.). Seedling plantings should exhibit a 70 percent or greater survival rate and containerized plantings should have 85 percent survival rate or better. Plantings not meeting these requirements will receive a reinforcement planting to improve stocking levels.

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BELTSVILLE AGRICULTURAL RESEARCH CENTER, MD

Background

Beltsville Agricultural Research Center (BARC) is located in the Maryland portion of the Anacostia watershed. The Anacostia watershed encompasses one of the most heavily populated and urbanized areas in the Chesapeake Bay watershed. Over 495,000 people currently live in the 120 square miles that make up the Maryland section of the Anacostia watershed. The pressures of urbanization are evident throughout the watershed. The bare soil of construction sites, run-down industrial areas, expanses of impermeable surfaces and tons of trash near streams are all signs of a degraded urban watershed. As a result of these and other problems, the Anacostia has been ranked the fourth most threatened river in the United States by American Rivers.

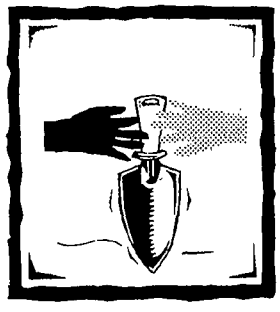
Nearly half of the tributaries in the Anacostia watershed pass through BARC. This provides an excellent opportunity to improve the water quality and overall health of the Anacostia River. At 6,582 acres, BARC represents almost 9 percent of the land area in the Maryland section of the Anacostia watershed. This is one of the largest land holdings under single ownership in the entire watershed, and with active management BARC can have a major impact on the condition of the Anacostia watershed and the people who live there.

The population in the Anacostia watershed reached 569,000 by 1980 and is expected to increase 17 percent by the year 2010

The last naturally reproducing population of brown trout in the Anacostia watershed is found in the Paint Branch, and there are a number of planting opportunities along this tributary on BARC property. By establishing riparian forest buffers, this habitat can be improved tremendously. Trees will not only filter nutrients from agricultural lands and shade the stream to provide the cool water temperatures that trout require, but they will also deliver the necessary cover and food that trout need to survive. Brown trout are highly intolerant of degraded water quality; if they are not protected, the trout will surely decline. Development in the Paint Branch sub-watershed has already put pressure on the fishery. Establishing riparian forest buffers at BARC can compensate for losses of habitat in other sections of Paint Branch and will help to increase the range and number of trout in the Anacostia watershed.

Perhaps the greatest advantage of establishing riparian forest buffers at BARC is the research opportunity it presents. Many questions still remain about planting forest buffers on or adjacent to agricultural land. Are riparian forest buffers compatible with agriculture? What establishment methods and techniques work best? What problems may be encountered when riparian forest buffers are planted? All of these questions and more must be answered before riparian forest buffers are fully accepted by the agricultural community. Establishing riparian forest buffers at BARC can provide insight that will be applicable throughout the Chesapeake Bay region to help farmers decide if forested riparian buffers are workable on their property. In this way, BARC can be a model for other agricultural landowners, both public and private. Creating riparian forest buffers at BARC will not only promote stewardship and water quality, but, hopefully, will also tie in with the research and investigation upon which BARC was founded.

The establishment of riparian forest buffers at BARC is being funded through a grant from the U.S. Environmental Protection Agency. The grant provides support for reforestation projects throughout the Anacostia watershed and is administered by the MD Department of Natural Resources Forest Service. The MD Department of Natural Resources Forest Service, in cooperation with BARC, will assume responsibility for funding as well as planning all reforestation projects.



Project Description

The restoration sites were chosen in March of 1995. At that time all of the chosen sites had flowing water, but many of the streams in this restoration project may be considered intermittent streams, and some may even be ditches. The selection process was intended to be as thorough as possible. In some cases the proposed reforestation sites did not comply with current BARC management objectives; however, these sites were identified strictly from a stream enhancement perspective. Although consideration was given to avoiding interference with farm activities, there may be some sites where future farm activities were not known. In these instances the proposed reforestation may be inappropriate. Additionally, there may be some sites that were not contained in this proposal that will become available for planting. As part of the restoration effort, twenty riparian forest buffer sites were chosen based on their proximity to watercourses.

By May of 1996, the first phase of BARC had resulted in 15 acres of BARC property being reforested with roughly 9,000 trees and shrubs. The average width of the riparian buffers is 100'. Buffer widths were based on standard accepted

guidelines. Where possible, a 100' buffer was proposed in accordance with United States Department of Agriculture (USDA) Forest Service guidelines. Where a 100' buffer could not be implemented because of fields, structures, roads or other restriction, a 50' buffer was proposed. A 50' buffer is considered the minimum buffer width for providing a full range of benefits to the stream. However, in a few situations only a 25' buffer was possible. Although this smaller width reduces the capabilities of the buffer, it is still preferred over no forest buffer at all. When designing buffer widths, consideration was given to the importance of future research. In addition, there was flexibility in the proposal to allow for smaller buffer widths where necessary to avoid ongoing agricultural research projects.

According to the US Forest Service, a riparian forest buffer is an area of trees and other vegetation which can intercept surface runoff, subsurface flow and deeper groundwater flows for the purpose of removing or buffering the effects of nutrients, pesticides or other chemicals from upland land use, which could otherwise enter bodies of water.

There are several sites where riparian forest buffers were increased beyond the standard guidelines. This occurred in areas where there was an expanse of open land that was not in production, and it appeared that a larger buffer could be established without impacting any ongoing farm operations. These larger buffers were proposed more for the wildlife and conservation benefits than from a water quality perspective. Large blocks of contiguous forest provide habitat for a broad array of wildlife, including many species of neo-tropical songbirds.

Methods of Planting

The BARC restoration sites are quite varied and will require different specifications for planting methods, spacing, species composition and size, site preparation and maintenance. Three plantings methods will be used to establish riparian forest buffers at BARC. Volunteer plantings, contract hand plantings and contract machine plantings will all be used for this reforestation effort. Each of these planting methods is appropriate under the right conditions, and more than one method will frequently be applicable to a particular site. The method chosen will depend on the size and location of the planting area, funding, soils and planting stock.

Volunteer plantings are one of the best methods for reforesting streamside buffers. Volunteers provide the manpower needed for planting the containerized trees without labor costs. When volunteer plantings are not feasible, contract hand planting and machine planting will be used. These two methods will require hiring a private company to carry out the riparian forest buffer plantings. These contract methods will contribute significantly to the cost of planting and can only be used when seedlings are being planted. Machine planting is appropriate on larger

sites or where the ground makes hand planting difficult. Hand planting is used for small, irregular shaped planting areas where a greater variety of seedlings are being planted. Machine planting does not usually provide opportunity for mixing different species.

The majority of the riparian buffer plantings at BARC will be done with seedlings. Seedlings are cheaper and are about 8-18" in height, making them much easier to transport, handle and plant than containerized or balled and burlapped (B&B) trees. Seedlings are also more likely to survive with little maintenance. However, for the sites around buildings, which are highly visible, the larger B&B and containerized trees will be used. This larger planting stock is usually about one inch in diameter and 6-8' tall. Containerized trees and shrubs also come in a range of sizes from 1-4', depending on species and supplier. Seedlings may be mixed in with B&B and containerized plants on some sites to add diversity to the planting. The spacing will depend on the size of the trees being planted. The larger B&B trees will be spaced approximately 15 X 15', which will require about 200 trees per acre. The smaller containerized trees will be planted on a 10 X 10' spacing with 435 trees per acre. The seedlings will be spaced on an 8 X 8' spacing with roughly 680 trees per acre. In all cases, attempts will be made to avoid an unnatural grid appearance.

Today, 50 percent or more of riparian forest buffers are disturbed or degraded, and more continue to be lost.

Seedling plantings can be accomplished by all three of the proposed planting methods. In order to insure seedling survival, it may be necessary to incorporate some type of site preparation with the seedling plantings. Site preparation will be used to reduce the competition from grasses and other herbaceous species. Site preparation may involve a herbicide application, discing or rotavating. In addition, most of the seedling plantings will require the use of tree shelters or fencing. Tree shelters and fencing are important in areas with high deer or rodent populations. Plantings with containerized or B&B stock will be carried out by volunteers. For these plantings, volunteers will dig the holes, plant the trees and mulch the area around the tree (approximately 1.5' radius around the tree).

A variety of species will be planted to establish riparian forest buffers at BARC. They include red maple, downy serviceberry, river birch, American hornbeam, hackberry, eastern redbud, flowering dogwood, green ash, common winterberry, black walnut, spicebush, sweetgum, yellow poplar, sweetbay magnolia, black gum, loblolly pine, sycamore, black cherry, white oak, pin oak, red oak, black willow, elderberry and arrowood viburnum. All of the chosen species are native to the state of Maryland. For most of the restoration sites, a mixture of hardwood trees and shrubs will be planted. Some areas will be planted with loblolly pine to provide

diversity and aesthetic value The combination of species to be planted on each site is flexible and will depend on available planting stock, soil conditions and planting method.

Monitoring

All planting sites will be checked to insure planting success. Survival counts will be taken for several years following the original reforestation. This will provide information not only on initial planting success but also on what other factors may impact reforestation attempts on agricultural land (e.g., deer, rodents, machinery, herbicides, etc.). Seedling plantings should exhibit a 70 percent or greater survival rate, and containerized plantings should have 85 percent survival rate or better. Any planting that does not meet these requirements will receive a reinforcement planting to improve the stocking levels.

Contact:

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BOWERSOX FARM, PA

Background

Bowersox Farm is one of the nineteen properties participating in the Donegal Creek Restoration Project. The section of Donegal Creek that runs through the Bowersox Farm stretches approximately 1,800' and flows through a fallow pasture. The Donegal Creek watershed is 17.2 square miles, or 11,008 acres. The watershed has been identified by the Commonwealth of Pennsylvania "State Water Plan" (SWP) as a high priority area for non-point source pollution (NPS) clean-up. The intense agricultural land use within the watershed is recognized as the main cause of stream degradation.

In a small stream, temperatures may rise 1.5 degrees in just 100' of exposure without trees

Due to the poor quality of the stream, the Lancaster County Conservation District and the Donegal Fish and Conservation Association formed a cooperative partnership to restore 6.67 miles of impacted stream corridor, beginning at the Donegal Creek/Chickies Creek confluence and ending in the headwaters of the east and west branch. This portion of Donegal Creek is still trying to recover from the pressure of cattle grazing that occurred in this area for decades. As a result, the stream channel is wide and shallow in most locations. It is hoped that the Donegal Creek restoration project will restore the once thriving trout fishery and improve the water quality, wildlife habitat and recreational value of the stream.

Project Description

On April 29, 1995, the Alliance for the Chesapeake Bay, the Lancaster County Conservation District and the Donegal Fish and Conservation Association sponsored a riparian forest buffer strip planting of 2,000 trees at the Bowersox Farm. The Bowersox Farm forest buffer measures 800' long and is approximately 50' wide. This buffer contains four rows of hardwoods (with an occasional conifer) along the stream and two additional rows of shrubs. The species of trees and shrubs planted included pin oak, shagbark hickory, red maple, silky dogwood, red-osier dogwood, grey-stem dogwood, sycamore and hybrid poplar.

In addition, the Partnership has installed the following streambank stabilization improvements: five rock frame deflectors, one jack dam, approximately 60' of rip-

rap bank stabilization and four half-log houses. There are plans to install two more jack dams, 10 rock frame deflectors and eight half-log houses.

Nonpoint source pollution accounts for more than 50 percent of the pollution in our nation's waters

Monitoring

The Partnership is intending to monitor the physical-chemical parameters and aquatic macroinvertebrate community within the project target area. A preliminary water chemistry and biota report for the upper reaches of the west branch (Donegal Springs area) has already been completed. The survival rate will be assessed by Lancaster County Conservation District personnel. Presently, the survival rate for trees at the Bowersox Farm is assessed at 75 percent.

Contact:

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Lancaster County Conservation District
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CHALLENGER SEVEN MEMORIAL GROVE, MD

Background

The Challenger Seven Memorial Grove is located at the Naval Air Station in Lexington Park on the Patuxent River in Maryland. The Patuxent River, one of the major tributaries of the Chesapeake Bay, flows through 110 miles of Maryland's diverse landscape and is the longest river located entirely within the state of Maryland. The drainage basin of the Patuxent River occupies approximately one-tenth of the state's total land area. Due to the rolling to flat terrain of its Coastal Plains, the Patuxent watershed is characterized by highly erodible soils. Consequently, the water quality of the Patuxent River has been degraded.

The Challenger Seven Memorial Grove, dedicated on April 20, 1990, was designed to commemorate the pioneering spirit of the Challenger crew. The Grove is also intended to convey to visitors to the site an understanding of the vital importance of trees in an ecosystem and their responsibility as stewards of the land.

> *"Trees are one of the organisms basic to life on earth, and it is absolutely vital that we assure their survival. It is tied to our own continued existence. It is appropriate that we should choose to plant living memorials to Challenger Seven's crew, for trees contribute so much to life and that earthly beauty one sees from space."*
>
> **Frank Lacer**
> **Guest Speaker, Challenger Seven Memorial Grove Dedication**

The Grove serves as a windbreak and a forested green belt along the Patuxent River. This particular site was chosen because of its highly visibility, which was desirable for large gatherings. In addition, the habitat could be improved without impacting adjacent land usage. The site is located in a rural setting. Prior to the tree planting, the dominant vegetative species were Japanese honeysuckle, sumac and autumn olive.

Project Description

On April 20, 1990, about 300 school kids from St. Mary's County and Brownie

Troop 807, with the assistance of 300 active duty military personnel, each planted seven trees to commemorate the crew of the Challenger Space Shuttle. In all, the volunteers planted 2,100 seedlings. The restoration effort resulted in four acres of buffer being planted. The planting measures 200' by 1,200'. The average width of the riparian forest buffer is 125' The seedlings were planted on a 10 X 10 spacing using shovels and augers. The following varieties of seedlings were planted: red oak, yellow poplar, sawtooth oak, flowering dogwood, white pine, green ash and red osier dogwood. Loblolly pines were later planted to replace some of the white pines that did not survive the first year.

> ***"What we're doing is really important. It represents the tree of life, which starts when you're a baby and goes on until you die."***
>
> ***Kenneth McMaster***
> ***4th Grader, Carver Elementary School***

Monitoring

There will be no ongoing monitoring of this buffer; However, the survival rate will be assessed. Presently, the survival rate of trees at the Challenger Seven Memorial Park is 80 percent.

Contact:

Naval Air Station
Natural Resources Office
Public Works Department
(301) 342-3670

** Please note public access to this buffer demonstration is extremely limited.*

CHAPEL POINT STATE PARK, MD

Background

Chapel Point State Park is located in the Charles County town of Marbury, Maryland. The Chapel Point State Park encompasses 827.5 acres and is located adjacent to Port Tobacco River. Port Tobacco River is one of many tributaries that flows into the Potomac River. The Potomac River sweeps nearly 400 miles across the Atlantic Piedmont and Plain to form the fourth largest watershed on the East Coast and one of the nation's most bountiful and historic rivers.

Along with point source pollution, the main threat to the health and productivity of the Potomac River is excess sediment. Sediment is carried to the Potomac River from its tributaries, including the Port Tobacco River. Approximately two-thirds of this sediment stems from the erosion of agricultural land; the rest comes from construction sites and other sources throughout the Potomac watershed. The Chapel Point State Park riparian forest buffer will help reduce the amount of sediment entering the Port Tobacco River, which will have favorable impacts on the Potomac River and ,ultimately, the Chesapeake Bay. The main objectives for the restoration effort at the Chapel Point State Park are improved water quality and established forested buffer strips along the Port Tobacco River.

According to the most recent available estimates, nearly one million tons of sediment washes into the tidewater Potomac annually.

The establishment of riparian forest buffers at Chapel Point State Park was made possible with funding by the Maryland Greenways Program. The Greenways Program provides long-term assistance to protect public lands and coordination with federal and local governments and the private sector on a statewide Greenway network, of which stream and river valleys are an essential part. The Greenways Program also prepares scenic river plans and assists local governments in developing long-term management strategies through the Scenic and Wild Rivers Program.

Project Description

In April of 1993, 22 acres of loblolly pine were planted along the Port Tobacco

River in the Chapel Point State Park. The riparian forest buffer planting was done by Maslen and Spence, a private contracting firm. In all, 13,000 loblolly trees were planted. The trees, which were established by machine planting with Cust to control grass competition, are spaced 7 X 10' apart and extend for 3,000 linear feet. The average width of the riparian forest buffer is 300'; however, in some sections the buffer extends 1,000'. Streambank stabilization was not a part of the Chapel Point State Park restoration effort.

Monitoring

The restoration site at the Chapel Point State Park will be monitored and the survival rate assessed by MD Department of Natural Resources Forest Service personnel. Presently, the survival rate of the buffer planting is assessed at 90 percent.

Contact:

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DIFFICULT RUN, VA

Background

The Difficult Run watershed, the largest watershed in Fairfax County, Virginia, is one of the tributaries of the Potomac River. The Difficult Run drainage includes ten tributaries and encompasses approximately 56,566 acres. The watershed is 80 percent developed and is used in a variety of ways, including housing, shopping malls, recreation and some agriculture. In spite of its urban location, Difficult Run teems with deer, fox, amphibians, waterfowl and many bird species, including hawks. However, increasing urbanization has resulted in serious flooding and soil erosion as well as degraded water quality. As a result, Difficult Run it is now listed as a critical watershed in Virginia.

The population within the Bay watershed is projected to grow by nearly one million people by the year 2000 and by 2.6 million people by the year 2020

The main objective of the Difficult Run Urban Reforestation Project is to moderate nutrient influx in floodwater runoff. Additional objectives include stabilizing streambanks and improving wildlife habitat. The restoration sites were chosen because they were determined to lack sufficient forest buffer to adequately control and process floodwater runoff.

The Virginia Department of Forestry (VA DOF), the Fairfax County Park Authority (FCPA) and the Fairfax ReLeaf recently dedicated the Difficult Run Urban Reforestation project. The dedication site is located adjacent to Route 7 near Carpers Farm Way in Vienna, Virginia. A sign identifying the project and the participating organizations was placed next to Route 7.

Project Description

The Difficult Run Urban Reforestation Project has been initiated in four phases, with Phases I, II and III completed by Spring 1995. As part of these three phases, approximately 45 acres of vegetation was planted on both sides of Difficult River by volunteers from Fairfax ReLeaf, DC Cares and local Boy Scout troops. The average width of the riparian forest buffer is 40'; however, in some sections the buffer extends to 100'. The buffer protects 6,875 linear feet of stream. In all, 8,750 seedlings of alder, apple ash, dogwood, sweet gum, red maple, water oak, white oak, willow oak, persimmon, poplar, walnut, sycamore and river birch were

planted. Although the funding for the project's different phases has not come from the same source, the objectives have remained the same. Phase IV, which is in progress, is focused on raising public awareness concerning riparian buffers in urban settings and involves more networking with communities for post-planting monitoring.

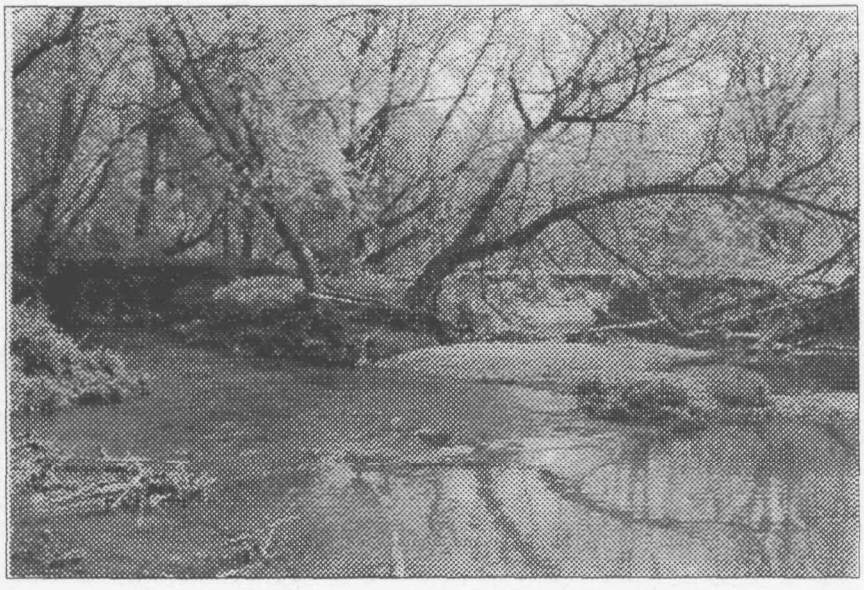
Several additional projects in the Difficult Run Restoration took place in late 1995 and early 1996. These projects included a planting of 600 tree seedlings adjacent to a stream in Herndon, a planting of 50 seedlings in conjunction with a school age Earth Conference in Reston, an installation of a 250 plant buffer adjacent to Links Pond on Reston International Golf Course property, and a planting of 600 tree and shrub seedlings along the Difficult Run mainstem in Vienna.

Monitoring

No monitoring of the Difficult Run Urban Reforestation Project has been completed. However, the survival rate of the vegetation will be assessed by VA DOF personnel and volunteers. Presently, the average survival rate is assessed to be between 70-75 percent.

Contact:

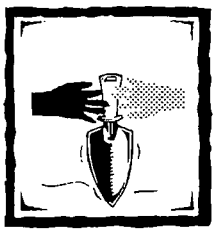
Judy Okay
VA Department of Forestry
(703) 324-1489



DONEGAL CREEK, PA

Background

The Lancaster County Conservation District and the Donegal Fish and Conservation Association have formed a cooperative "Partnership" for the purpose of restoring 6.67 miles of Donegal Creek. Donegal Creek, a tributary of the Susquehanna River, is a limestone trout stream located in the northwest corner of Lancaster County, Pennsylvania. The Partnership refers to their undertaking as the "Donegal Creek Restoration Project." This riparian forest buffer restoration project is being approached and implemented from a "Riparian Corridor Management" perspective.



The Donegal Creek watershed covers 17.2 square miles, or 11,008 acres. The watershed has been identified by the Commonwealth of Pennsylvania "State Water Plan" (SWP) as a high priority area for non-point source pollution clean-up. The intense agricultural land use within the watershed is credited as the main cause of stream degradation. As a result of the degraded water quality in Donegal Creek, the Partnership began corrective action beginning in the summer of 1994. The Partnership's project target area consists of 6.67 miles of impacted stream corridor beginning at the Donegal Creek/Chickies Creek confluence and ending in the headwaters of the east and west branch.

Cropland erosion accounts for 38 percent of the approximately 1.5 billion tons of sediment that reach the nation's waters each year

The Partnership is currently working in the headwaters of the west branch, which encompasses the Donegal Springs area. Four landowners in the Donegal Springs area are currently involved in the restoration project and have had various corrective improvements already installed on their property. To date, the Lancaster County Conservation District and the Donegal Fish and Conservation Association have donated all the necessary materials and labor required to make these improvements.

The Donegal Creek Restoration Project involves the following agencies and associations: Pennsylvania Fish and Boat Commission, Chesapeake Bay Foundation, Trout Unlimited, Alliance for the Chesapeake Bay, Pennsylvania Association of Conservation Districts, Pennsylvania Department of Environmental Protection, US Environmental Protection Agency, and Pennsylvania Department of Conservation and Natural Resources.

Project Description

The Partnership is currently working with four landowners in the Donegal Springs area and is proposing to work with the remaining 19 landowners within the project target area. The landowners have already been contracted either by a survey letter or a personal visit.

Within the project area, 14 of the 23 landowners allow free cattle access to the stream. These 14 cattle pastures make up approximately 4.7 miles of the total 6.67 miles of project target area. The Donegal Creek exhibits some prime examples of the impacts that cattle have on streams. At Donegal Springs (the headwaters of the west branch), the stream width at water level measured 12' and had an average depth of 11". These measurements were taken where the stream was in an unimpacted, wooded condition, just before entering one of the pastures that was slated for restoration. The stream width and depth was then measured along the pasture, 100' downstream of the wooded location. Along the pasture, the stream width had increased to 28' and had an average depth of only 4". The dairy cattle, which had free access to the stream, had clearly made the difference. Within this same pasture, which contains 1,000' of stream corridor, only a single tree was found in the riparian area.

> ***"Not only the stream, but the farmer benefits too, with herd health, with stream and water quality - because the herd will be drinking from this water - and also twisted ankles on the bank, mastitis and water-borne bacteria. It's a conscientious effort between the landowner and the neighbors helping out."***
>
> ***Travis Martin***
> ***Lancaster County Conservation District***

Non-point source pollution resulting from agricultural activities is not only a major problem in the Donegal Creek watershed, but also in the downstream Susquehanna River and the Chesapeake Bay. The Donegal Creek Restoration Project will reduce various pollutant sources, such as pesticides and nutrients, related to the intense agricultural land use surrounding Donegal Creek. Although it will take a while to establish and mature, the re-establishment of a riparian forest buffer will most likely be the most significant improvement resulting from this stream corridor restoration project.

The Partnership anticipates the Donegal Creek Restoration Project to result in the following:

Restoration Efforts

Streambank fencing and cattle crossing
The Partnership plans to install streambank fencing in 15 different cattle pastures. This fencing will protect approximately 4.9 miles of the total 6.67 miles of project target areas from cattle access to the stream. Fences will be installed as far back as the landowner will allow, but not less than 10' from the streambank. Additionally, 21 stone ford cattle crossings will be installed in combination with the streambank fencing.

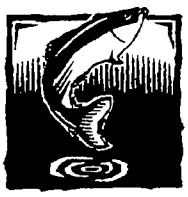
Fish enhancement structures
Approximately 134 rock frame and log frame deflectors, 3 porcupine deflectors, 24 Jack Dams, 15 wood slat fish houses, 40 half-log houses and 100 tons of boulder replacement will be installed.

Riparian buffer strips
Riparian forest buffer strips will be planted and re-established along the project's 6.67 miles of stream corridor. The forest buffer strip is at least 10' wide, as it is confined to the limits of the stream bank fencing, and in some circumstances the buffer exceeds 50' in width. This restoration will involve the planting of more than 27,733 tree seedlings. Tree protectors will occasionally be utilized on the following hardwood seedlings: red maple, shagbark hickory, shellbark hickory, white ash, slippery elm, American planetree and flowering dogwood. The labor for all the riparian forest buffer strip establishment is being provided by the Partnership and other volunteer groups (e.g. scouts, schools, churches).

> ***"The Donegal Fish and Conservation Association operates a cooperative nursery with the Pennsylvania Fish Commission, and we stock the Donegal Creek. And this used to be, years ago, nursery waters. There were large native fish that used to inhabit these waters, and we would like to see the stream revert back to that same scenario"***
>
> **Tom Moore**
> **Coordinator, Donegal Fish and Conservation District**

Streambank stabilization
The restoration effort will also involve stabilizing eroded streambanks along the project's 6.67 miles of stream corridor. Where appropriate and necessary, sections of eroded streambanks will be stabilized using the following techniques:

- bio-engineering;
- rip-rapping;
- mud sill installation and
- use of porcupine, rock frame and log frame deflectors.



Re-establishment of the trout population

The Partnership believes natural trout reproduction will be possible in the Donegal Springs area, where a propagation area has been established on two of the landowners' property. Sport fishing is not allowed in this area. Any adult fish, either living in this area or traveling to it, should be undisturbed during spawning season.

Goals and Objectives

The Donegal Creek Restoration Project emphasizes "Riparian Corridor Management." The Partnership intends to continue work in the east and west branches and then proceed downstream. The Partnership will generally be focusing on the installation of the following: stream bank fencing, stone ford cattle crossings, forest buffer strips, stream bank stabilization and fish enhancement structures. Each of these corrective improvements is discussed below.

1. Stream bank fencing
   - Fences will be installed as far back as the landowner will allow, but no less than 10'.
   - All fencing will be maintained by the Partnership.
   - Each individual fence will have its own power source. The power source will be either a 6 or 12 volt powered fence charger.

2. Stone ford cattle crossings
   - The Lancaster County Conservation District will oversee and design all crossings.
   - Normally, one crossing will be installed per 1000' of stream corridor that has been fenced to deny cattle access (unless the landowner's section of fenced stream is less than 1000').

The Partnership is approaching the project from a "Riparian Corridor Management" perspective. The Partnership is not only concerned about cattle with free access to the stream, but also the lack of native vegetation, a sediment-laden substrate and a wide, shallow channel due to various forms of accelerated erosion and resulting sedimentation.

3. Forest buffer strips
   - Forest plantings will entail the re-establishment of native flora.
   - Where appropriate, the Partnership will utilize bio-engineering methods such as:
     - live stakes and
     - fascines.
   - Planting bare foot seedlings will be the most common method of establishing a forest buffer

- The Partnership will perform any needed weeding and cutting of noxious weeds and undesirable exotic trees.
- No nitrogen fixing tree species will be planted because the Donegal Creek already has a nitrate problem.
- Tree protectors will occasionally be utilized on the following hardwood seedlings:
  - red maple
  - shagbark hickory
  - shellbark hickory
  - white ash
  - slippery elm
  - American planetree
  - flowering dogwood
- Forested buffers will be as wide as the landowner will allow. Generally, the fenced corridor along the stream will determine the width.
- Labor for all forest buffer strip establishment will be provided by the Partnership and other volunteer groups

4. Stream bank stabilization
   - The Lancaster County Conservation District will process the necessary permits.
   - The Lancaster County Conservation District will notify the appropriate agencies and municipalities as per permit conditions.
   - Where appropriate, the Partnership will utilize bio-engineering methods such as:
     - live stakes and
     - fascines.
   - Where appropriate, the Partnership will utilize rip-rap for stabilizing severely eroded vertical banks.
     - Only limestone rock will be used since the Donegal Creek is a limestone stream.
     - All rip-rap will be a minimum size of R-4.
     - Rip-rap must be angular in shape thereby ensuring that rip-rap material can withstand anticipated velocities.
     - Rip-rap will only be used as a bank stabilization method when necessary due to severe erosion.
     - The Lancaster County Conservation District shall oversee all rip-rap installations.
     - No purchased rip-rap materials will be used to build

vertical masonry walls as a form of streambank stabilization.

- All installed rip-rap will be installed as natural as possible.
- Native vegetation will be encouraged to grow among placed rip-rap. Live stakes incorporated with rip-rap is one method commonly used to accomplish this.
- Rock frame deflectors will be utilized where there is a solid substrate.
- Log frame deflectors will be used where it is possible to correctly anchor the device with re-bar.
- All anchoring re-bar will normally be at least 3' in length.
- All re-bar will be sent over and made flush with the log to prevent snagging of floating debris.
- All logs will be either black walnut, pin oak, eastern red oak or other suitable hardwood species; conifer species will not be used.
- Porcupine deflectors may be utilized in backwater conditions and/or where the anticipated velocity is less than 8 FPS. Leftover Christmas trees are often used to construct porcupine deflectors.

In the Bay watershed, there are 100,000 miles of streams, rivers and shorelines

5. Fish enhancement structures
   - The Partnership will install and maintain all structures.
   - The Lancaster County Conservation District will oversee the installation of all structures.
   - All structures will be made from natural materials. No tires, concrete block, spoil asphalt, plastics etc. will be used. Necessary re-bar and nails for anchoring purposes will be allowed.
   - No structure will be higher than 1' above normal summer flow elevation.
   - No structure will block the mitigation of fish.

6. The district also plans to work with the farming community on manure management. As opportunities arise, the District will utilize already existing programs to cost-share conservation practices where necessary. This restoration project offers a perfect opportunity for the District to get additional farmers involved in the Chesapeake Bay Program.

Milestones

March 1, 1995 - April 1, 1995:
The Partnership has contacted all 23 landowners in the project target area.

August 11, 1995:
A hands-on workshop was held on one of the properties in cooperation with PACD.

February 1, 1996 February 1, 1998:
Installation of stream bank fencing and associated stone ford cattle crossings in the remaining 14 cattle pastures will be completed to limit free cattle access to the stream.

February 1, 1996 - February 1, 1999:
Installation of necessary forest buffer strips, stream bank stabilization and fish enhancement structures will be completed. These improvement will only be installed in the cattle pastures upon completion of necessary stream bank fencing, Work will continue in the west branch and will then switch to the east branch. Upon completion of the east branch, work will proceed downstream on the main stem.

February 1, 1996 - indefinitely:
The Partnership will maintain all improvements. The Partnership will sponsor various open houses and /or workshops for various groups.

Recognition

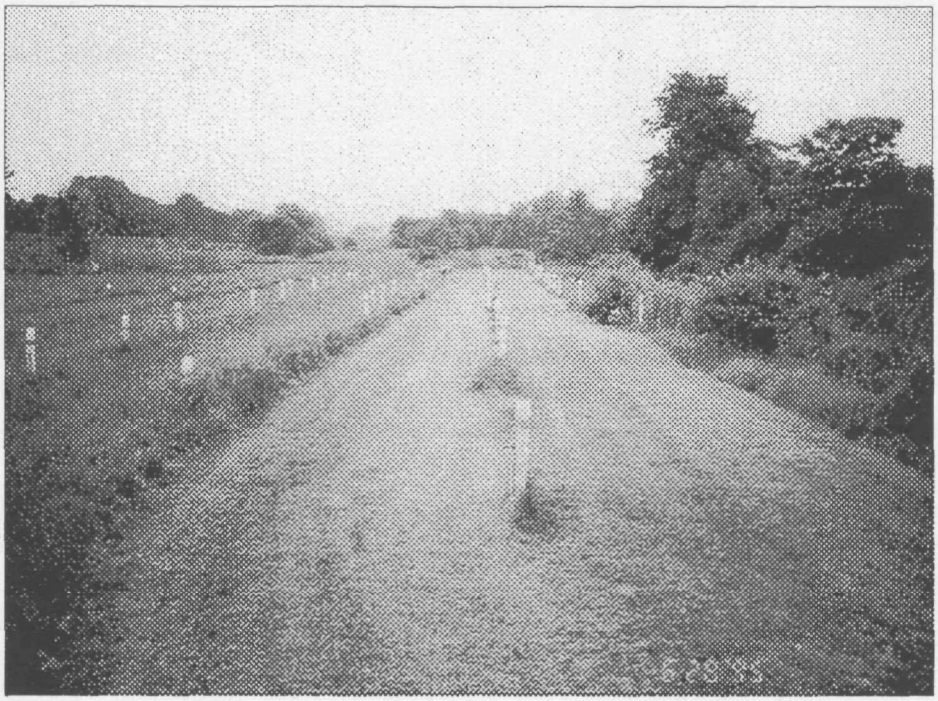
The Donegal Creek Restoration Project and Lancaster County Conservation District were recognized in November 1995 with a "Land Stewardship Award" by the Chesapeake Bay Program.

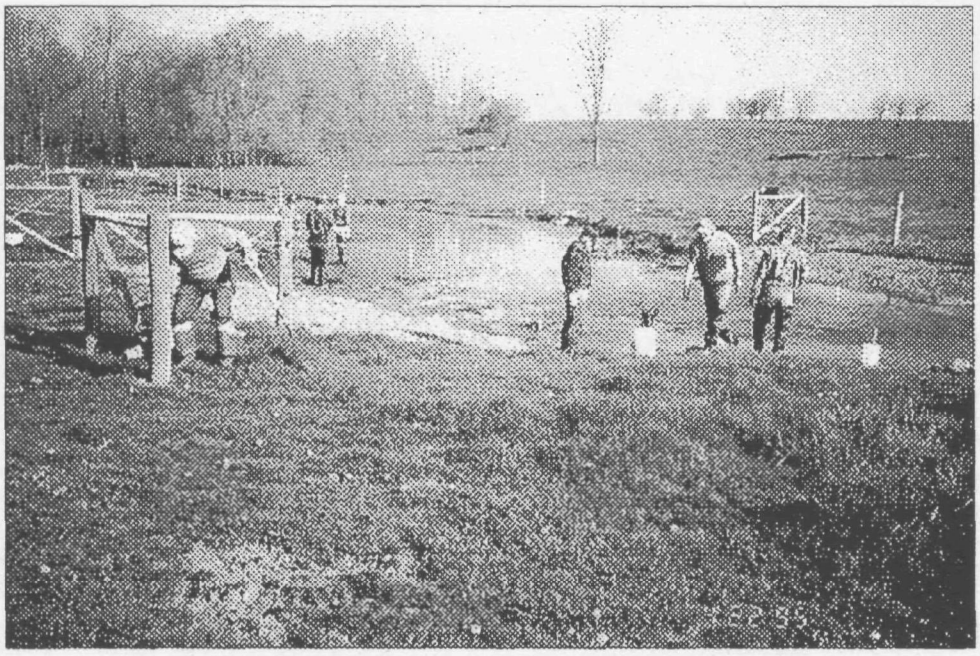
Monitoring

The Partnership proposes to continue to monitor the physical-chemical parameters and aquatic macro invertebrate community within the project target area. A "Preliminary Water Chemistry and Biota Report" for the upper reaches of the west branch (Donegal Springs area) has already been completed.

Contact:

Mark Metzler
Lancaster County Conservation District
(717) 299-5361





EDEN MILL PARK, MD

Background

Eden Mill Park is a 57.5-acre county park located in northern Harford County, Maryland. Eden Mill Park borders Deer Creek for approximately 4,000 linear feet. Deer Creek, the largest tributary in Hartford County, flows into the Susquehanna River. The Susquehanna is the largest tributary river to the Chesapeake Bay and adds an astonishing 19 million gallons of freshwater to the Bay every minute. The population in the Susquehanna basin increased by 19 percent, more than half a million people, between 1950 and 1980. Changes in land use have accompanied this population growth. As a result of these significant changes, the Susquehanna River is experiencing nutrient, toxics and sediment pollution.

Eden Mill Park is a county park used primarily as a field trip site for local school kids; its facilities include a educational center and nature trails. The specific goals of the Deer Creek restoration effort are improved water quality, wildlife habitat and stabilized streambanks.

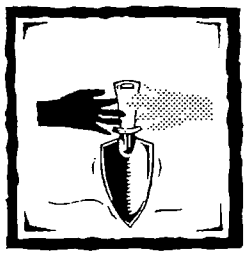
Susquehanna River Land use Statistics

Cropland	**17%**
Pasture	**18%**
Forest	**62%**
Urban and Other Uses	**3%**

This riparian forest buffer was established, maintained and reinforced by the Maryland Department of Natural Resources Forest Service and Eagle Scout Eric Wolfe of Scout Troop #238. Eric raised $300 to purchase 20 balled and burlapped (B&B) TreeMendous Trees for this restoration project.

The restoration effort is proceeding in two phases. Phase I, which has been completed, involved the area downstream from the Eden Mill Dam construction area. Phase II will involve the area above the Dam and will occur after the completion of construction.

Project Description



As part of Phase I, Eagle Scout Eric Wolfe, along with MD Department of Natural Resource Forest Service personnel, planted six hundred seedlings (1.4 acres) to reinforce the existing forest buffer in April of 1995. The buffer measures 1,200 linear feet and is 50' wide. It consists of the following species: willow oak, green ash, river birch, eastern redbud, pin oak and serviceberry. In addition, TreeMendous Trees containerized stock of American sycamore, pin oak,

sweetgum, green ash and red maple were used. As part of the streambank stabilization, red osier dogwood and speckled alder were planted 10' X 10' along the Deer Creek streambank.

Phase II will occur after the construction of the new Eden Mill Dam. The extent of the impounded water will determine the need for riparian forest buffer establishment. A planting plan for Phase II will be written by a forester from the MD Department of Natural Resources Forest Service upon request by personnel from Eden Mill Park after the construction work is completed.

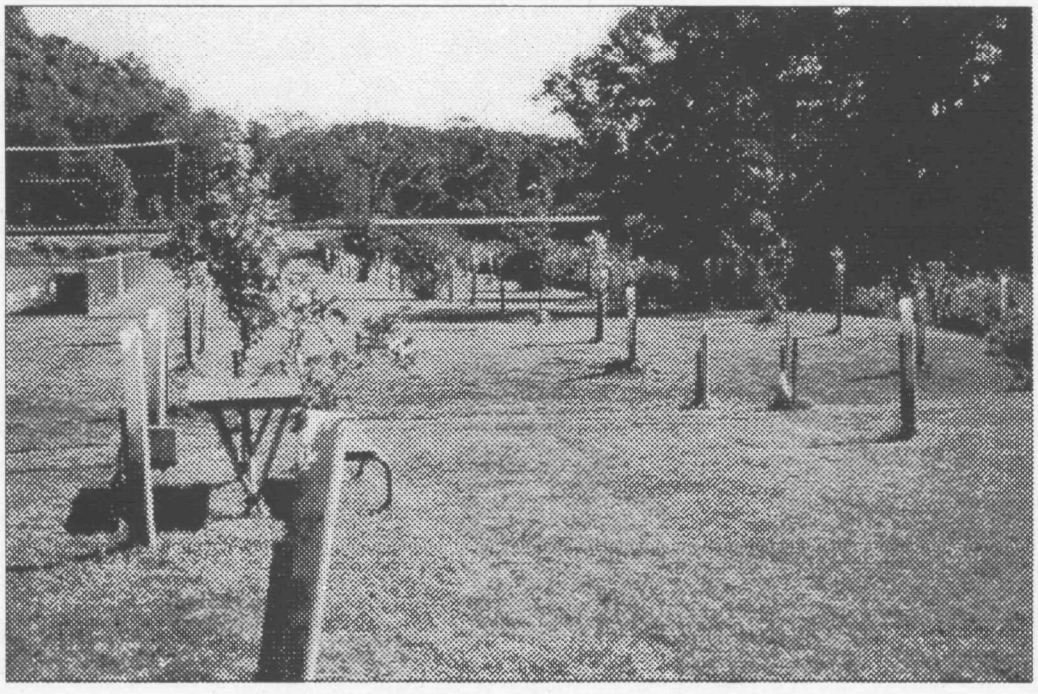
According to estimates, over 7 tons of soil per acre of cropland are lost every year in the Susquehanna basin.

Monitoring

The reforestation planting done at Eden Mill Park will not be monitored for water quality. However, the survival rate will be assessed by MD Department of Natural Resources Forest Service personnel. Presently, the survival rate of the trees is assessed at 98 percent after the Phase I reinforcement.

Contact:

Michael Huneke
Maryland Department of Natural Resources Forest Service
(410) 836-4551



FOUR MILE RUN, VA

Background

Four Mile Run, which flows through Arlington County, Virginia, is a tributary of the Potomac River. Nearly twenty square miles of land drain into Four Mile Run. This drainage area contains 60 percent of Arlington County, as well as parts of Fairfax County and the cities of Falls Church and Alexandria. The Four Mile Run watershed is heavily urbanized, with 40 percent of the land covered by impervious surfaces, such as highways, parking lots and rooftops.

The Izaac Walton League's Save Our Streams (SOS) restoration demonstration project is located in East Falls Church Park, an open park with recreation fields, a playground and a heavily traveled foot/bicycle path. The restoration site is located approximately eight miles from the confluence of Four Mile Run and the Potomac River in the uppermost quarter of the watershed. Four Mile Run is heavily degraded from nonpoint source pollution and was also experiencing streambank erosion. In many reaches, banks were vertical and were sloughing into the stream thereby contributing to a heavy sediment load.

The goals of the restoration project were to conduct a stream habitat restoration project that repairs the streambanks and re-establishes soil-binding streambank vegetation; to provide hands-on bioengineering training for local citizens who might seek similar solutions to problems on their streams and to demonstrate the necessity of recruiting a diverse array of stakeholders to successfully complete a habitat restoration project.

Project Description

The project, which was broken into two units, repaired approximately 310 linear feet of streambank on May 7, 1994. The first unit was a 220-foot stretch on the inside of a shallow bend that fades into a 50-foot stretch of riprap armoring an active scour point. The project then resumes for another 90 feet, fading into riprap that protects the base of a footbridge. All work took place on the north bank of the stream.

Riparian forest buffers are the naturally occurring vegetation along streams.

The site was seeded with an equal mix of annual and perennial rye grasses. The annual grass provided immediate cover, and the perennial would

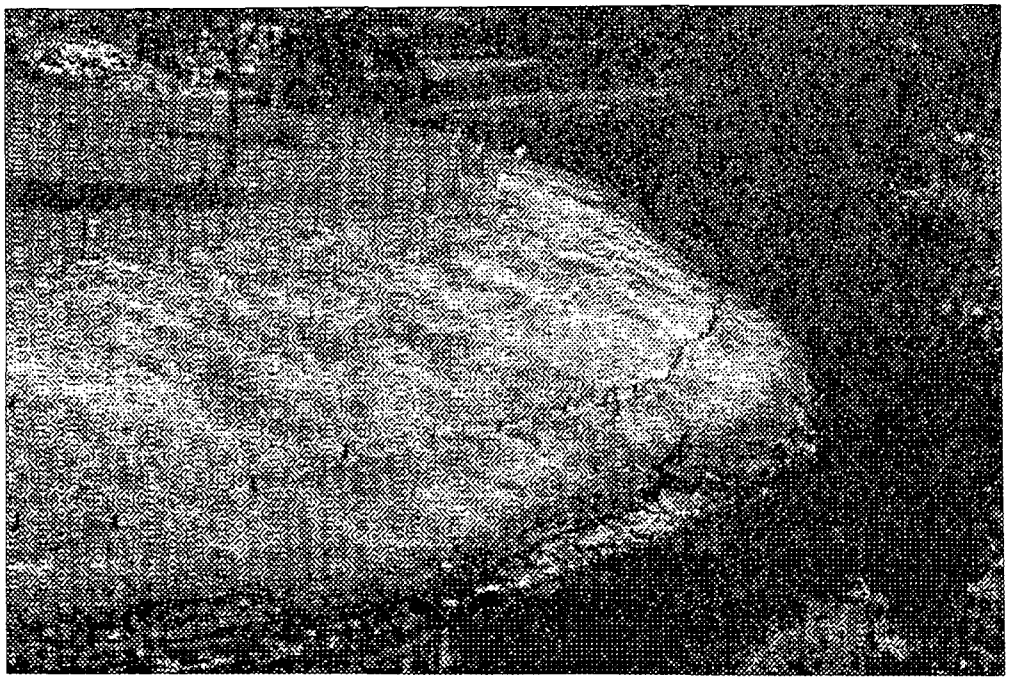
provide protection during the winter The site was mulched with a thin layer of straw to intercept rain drops and retain moisture near the soil, providing suitable conditions for plant growth. The entire bank was covered with an erosion control fabric mesh made of biodegradable jute. Volunteers planted 3,500 cuttings of red osier dogwood and bankers dwarf willow, each averaging seven feet in length. All plant materials were donated by the United States Department of Agriculture (USDA) Natural Resources Conservation Service Plant Materials Center. Finally, alders were planted at the top of the bank approximately four feet apart. They were marked with bright yellow flags so that park maintenance staff would not mow into the project.

Monitoring

The site will be monitored by Save Our Streams employees, and maintenance actions will be taken when necessary.

Contact:

Izaak Walton League of America
Save Our Streams
(800) BUG-IWLA



HOLLYWOOD BRANCH, MD

Background

The Hollywood Branch is located in Montgomery County, Maryland, just north of Washington, DC. The watershed drains approximately 1.3 square miles. Hollywood Branch flows into Paint Branch, a major tributary of the Anacostia River that supports a reproducing population of brown trout. The trout live upstream of the Hollywood Branch confluence. The predominant land use in the Hollywood Branch watershed is residential housing. Most homes are single dwellings on approximately ¼ acre lots. This area is heavily crisscrossed by roads, and several large roads serve as major arteries for the area.

Areas covered with trees and shrubs absorb 14 times more rainfall than a mowed lawn.

As a result of the development in the watershed and the conveyance of stormwater into the stream channel, streambank erosion is an obvious problem in many parts of the Hollywood Branch watershed. Streambanks were vertical and sloughing into the stream. Many of the large trees have exposed roots and are leaning precariously toward the stream channel. The Hollywood Branch Restoration Effort was performed by 12 environmental educators participating in the Save Our Streams Summer Water Institute. Also volunteering were Montgomery County teachers from Kensington Parkwood Elementary and Rockville High School.

The restoration demonstration project is located in Martin Luther King, Jr. Regional Park. The park is managed by the Maryland National Capital Parks and Planning Commission. The project is located in a narrow finger of land that runs upward from the northeast corner of the park. The site is located in a nontidal wetland, characterized by lush growth of rushes, sedges and other types of frequently encountered wetland vegetation. The site is approximately ½ mile above the confluence of Hollywood Branch and Paint Branch.

Project Description

The Hollywood Branch restoration project took place on July 12, 1995, and repaired approximately 110 linear feet of streambank. Volunteers sloped the streambank, placed riprap along the toe of the bank, planted streambank vegetation, seeded and mulched the restoration site and secured the streambank with erosion control fabric.

Volunteers also planted a total of 50 black willow and silky dogwood saplings, with one half of the trees (25) planted in each row. The entire site, including the areas disturbed by the heavy equipment, were seeded with a mix of annual and perennial rye grass. Volunteers covered the entire site with straw mulch to provide immediate protection against rain. The straw will serve an important erosion protection function until the grass becomes established as a permanent soil cover.

Monitoring

Until the plants become well established, which may take two to three growing seasons, a local Montgomery County Stream Team has been set up in case the plants need to be watered. Structurally, the maintenance requirements are minimal. The silt fence must be watched until the grass and woody plants are established to stop any sediment-land overland runoff from entering the stream. The woody plants may require pruning in the future to stimulate accelerated lateral growth in the form of new roots and shoots. Eventually, with proper management, this site can provide a large number of cuttings for future streambank projects.

Contact:

Izaak Walton League of America
Save Our Streams
(800) BUG-IWLA

HURSH FARM, PA

Background

Hursh Farm is one of the nineteen properties that is participating in the Donegal Creek Restoration Project. Donegal Creek, which empties into Chickies Creek, is a limestone trout stream located in the northwest corner of Lancaster County, Pennsylvania. The Donegal Creek watershed is 17.2 square miles, or 11,008 acres. The intense agricultural land use within the watershed is recognized as the main cause of stream degradation. Due to the poor water quality of the stream, the Lancaster County Conservation District and the Donegal Fish and Conservation Association formed a cooperative partnership to restore the once thriving trout fishery and improve the water quality, wildlife habitat and recreational value of Donegal Creek.

> *"What makes this project unique is that is was done strictly from a conservation standpoint because the landowner had no concerns of anyone hunting or fishing in here. An environmental approach was used as the selling point."*
>
> **Tom Moore**
> **Coordinator, Donegal Fish and Conservation Association**

The section of Donegal Creek that runs through Hursh Farm stretches for 1,000' and flows through a dairy pasture. The stream has been heavily impacted by cattle; the steam channel was wide, shallow and lacked adequate cover for aquatic organisms. When the restoration project is completed, this stretch of Donegal Creek will have received the most intensive corrective work.

All materials, including the trees, shrubs, fence, solar charger and stone for the Donegal Creek Restoration Project at the Hursh Farm were donated by local businesses, conservation organizations and state and federal agencies.

Project Description

In August of 1994, volunteers fenced 1,000' of Donegal Creek on this property. The volunteers also constructed a cattle crossing to allow the cows to reach the adjacent meadow or drink from the stream without hurting themselves or the environmentally fragile waterway. In April of 1995, volunteers from the Lancaster Conservation District and the Lancaster Stream Bank Fencing Work Group planted over one

thousand (0.5 acres) trees and shrubs along 1,800' of the stream corridor. The average width of the riparian forest buffer is 10'. The species planted include: streamco willow, silky dogwood, grey dogwood, red osier dogwood, poplar, green ash, black walnut, shagbark hickory, shellbark hickory and red maple.

There are plans to install fish enhancement structures in this section of Donegal Creek. Approximately 24 log frame deflectors, two wood slat fish houses, one jack dam and some boulder placement will be used to make this section of the stream more hospitable to fish.

Riparian forest buffers are the naturally occurring vegetation along streams

Monitoring

The Partnership intends to monitor the physical-chemical parameters and aquatic macroinvertebrate community within the project target area. A preliminary water chemistry and biota report for the upper reaches of the west branch (Donegal Springs area) has already been completed. The survival rate will be assessed by Lancaster County Conservation District personnel. Presently, the survival rate for trees at the Hursh Farm is assessed at 75 percent.

Contact:

Mark Metzler
Lancaster County Conservation District
(717) 299-5361

LICKINGHOLE CREEK, VA

Background

Lickinghole Creek is a small stream that originates 2,420' above sea level in the Blue Ridge Mountains of Virginia. Located entirely within Albemarle County, the Lickinghole basin drains 13.7 square miles of predominately agricultural land. Lickinghole Creek flows east by southeast and merges with many other small streams before it enters the South Fork Rivanna River Reservoir, which provides drinking water to the city of Charlottesville and surrounding towns. Its waters leave the reservoir and become part of the James River. The James River flows for 450-miles as it works its way to the Chesapeake Bay. Agricultural development in this part of Virginia has altered the natural landscape for hundreds of years. As a result, eroding streambanks caused by cattle grazing and the removal of riparian forest buffers are commonly seen.

Approximately two million people, nearly one third of Virginia's population, live in the James watershed. This figure is projected to grow to 2.3 million by the year 2000.

Lickinghole Creek supports a diverse aquatic community, although nonpoint source pollution from cattle manure and streambank erosion is an obvious problem. The restoration demonstration project is located just west of the town of Crozet on land owned by a local farmer. The project is in the upper quarter of the watershed, approximately 5.5 miles from Lickinghole's confluence with the Mechums River.

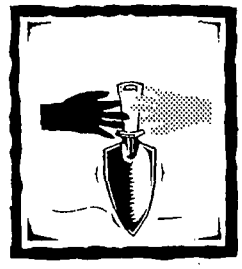
Project Description

The project repaired approximately 240 linear feet of streambank on June 4, 1994, along the north bank of Lickinghole Creek. Prior to the plantings, a backhoe was used to slope the streambank, eliminating its vertical position. Volunteers planted one thousand cuttings of red osier dogwood and streamco willow, each averaging 5 feet in height. These species are bred selectively for streambank stabilization applications and remain supple enough to lie flat against the bank during high flows. Most importantly, these species produce an enormous amount of deep subsurface root mass that provides long-term soil binding. In addition, three hundred 1-foot root cuttings were donated for this project. The cuttings were a mixed set of alder, streamco willow and red osier dogwood. All plant materials were donated to the project by the United States Department of Agriculture Natural Resources

Conservation Service Plants Materials Center. When the plantings were completed, the entire bank was covered with an erosion control fabric mesh made of biodegradable jute.

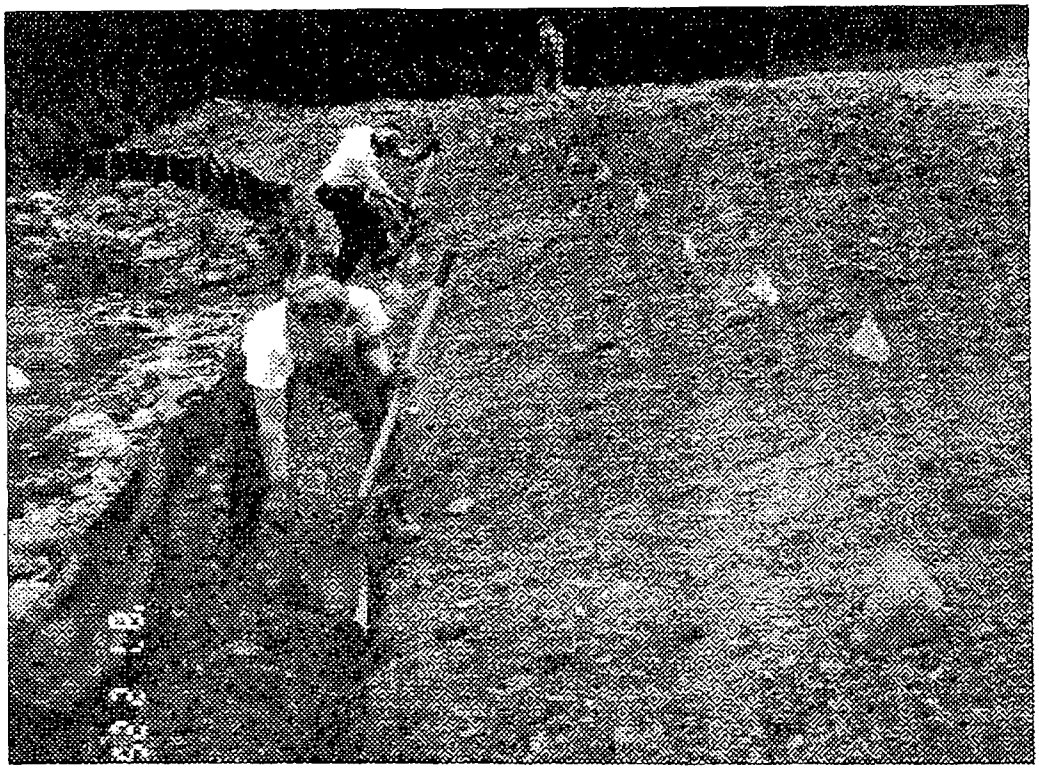
Monitoring

The restoration site will be monitored regularly, and maintenance actions will be taken when necessary. To date, the site has demonstrated structural soundness, and major maintenance seems unlikely. Because beaver activity was observed in the areas upstream from the site, sprouting willows and dogwoods should be inspected for animal damage and appropriate steps taken to allow plant growth. Finally, local volunteers and area officials are expected to monitor the site's water quality to assess the long-term water quality improvements in Lickinghole Creek.



Contact:

Izaak Walton League of America
Save Our Streams
(800) BUG-IWLA



LONG GREEN CREEK, MD

Background

Long Green Creek, which runs through Baltimore County, Maryland, is one of the tributaries of the Gunpowder River. Long Green Creek flows for about 4.13 miles and has a watershed that encompasses 14.3 square miles. The Long Green Creek flows primarily through an agricultural landscape with numerous pasture grasses. As a result of the agricultural activities along Long Green Creek, the stream has experienced declining water quality and streambank erosion, which have resulted in degradation of the stream's habitat.

Gunpowder River Land Use Statistics

	1973	1984-85
Residential	13%	15%
Commercial	2%	5%
Agricultural	33%	31%
Forest	37%	35%
Wetlands	1%	1%
Urban	3%	5%

About 10 years ago, Trout Unlimited (TU), a non-profit group made up of fishing enthusiasts, noticed a decline in the natural reproducing trout population in Long Green Creek. They worked their way up Long Green Creek using an electric shocking gun, a tool used to determine fish populations. TU conducted water quality analyses to determine the cause of the declining trout population and discovered that the trout populations were living in areas where there were more trees and lower water temperatures. TU believes that if the habitat and water quality conditions were improved in Long Green Creek, the trout would return. Therefore, TU, along with the Alliance for the Chesapeake Bay (ACB) and the U.S. Fish and Wildlife Service (F&WS), targeted Long Green Creek as a showcase for effective stream techniques that would improve the stream's habitat, as well as stabilize its eroding streambanks. The Long Green Creek Restoration Project is being approached as a watershed effort. As such, TU, ACB and F&WS have plans to conduct restoration projects at other sites along Long Green Creek.

Project Description

The Long Green Creek restoration project is being completed in three phases over a two year period. In April 1995, as part of Phase I, ACB volunteers fenced 1,200 linear feet of streambank and planted 2,000 live stakes and 1,500 seedlings of native tree species. These efforts have greatly improved the stabilization of the banks and floodplain. As part of Phase II, ACB sponsored a reforestation planting in October 1995. Volunteers planted over 420 containerized stock and 2,000 live stakes of native facultative and facultative wet species along the streambank. The riparian buffer width varies from 75' to over 150' due to the meandering of the

Long Green Creek. For Phase III, volunteers from ACB, Americorps, and the Gunpowder Valley Watershed Association fenced 1500' of streambank and planted approximately 10,000 seedlings of native floodplain tree species in April of 1996. In all, the Long Green Creek Restoration has resulted in about 1 mile of stream restored using vegetation and streambank fencing.

> *"Streamside forests are extremely important to the water quality and living resources in the Bay. When planted next to streams, trees act as buffers that help the Bay by reducing pollution and increasing habitat to offset the large amount of habitat that has been lost in the Bay watershed."*
>
> *Francis Flanigan*
> *Executive Director, Alliance for the Chesapeake Bay*

Monitoring

The Long Green Creek Restoration is now in the maintenance and monitoring phase. Members of the Gunpowder Valley Watershed Association are being trained by ACB staff to monitor physical measurements, which include shape, pattern, profile and fishery assessment and chemical analysis, including macroinvertebrate sampling. The survival rate of the vegetation will also be assessed by the Watershed Association staff, after training is provided by ACB staff. The survival rate is currently assessed at 85 percent.

Contact:

Glenn Page
Alliance for the Chesapeake Bay
(410) 377-6270

MONOCACY NATURAL RESOURCE AREA, MD

Background

The Monocacy River is the largest Maryland tributary to the Potomac River. It begins near the Maryland-Pennsylvania border west of Harney, Maryland, at the confluence of Marsh and Rock Creeks. The Monocacy watershed encompasses 774 square miles, or 476,200 acres, of which 75 percent is in Maryland and the rest in Pennsylvania. Roughly three-quarters of the land in the watershed has been cleared for agriculture; the remaining land supports forests, the City of Frederick and ever-growing residential neighborhoods.

The stream targeted for restoration is an unnamed tributary to Furnace Branch, which flows into the Monocacy River. The restoration site is located in a pasture that is actively grazed by cattle and was chosen because of the stream's poor water quality. This project was initiated by the MD Department of Natural Resources Forest Service.

The Monocacy watershed supports 3,500 farms, each averaging 150 acres. Crop land erosion ranges from 2 to 35 tons per acre.

The goals of the demonstration site are to explain the different methods of planting a riparian forest buffer, the different ways of caring for the tree seedlings, and the many benefits of forested buffers and other water quality projects. The buffer area contains a self-guided tour, which, along with a brochure, highlights the restoration effort as well as the benefits of forests and riparian buffers. In addition, recovering wetlands and native "volunteer" plants are pointed out in the tour.

Project Description

The initial planting occurred in 1990, with reforestations done in 1992 and 1993. As part of this restoration effort, 2,640 linear feet of stream and 11.4 acres of vegetation were planted. The average width of the buffer is 100' on both sides of the stream. Some of the trees were planted by hand using volunteers on Earth Day. The volunteers included local Boy Scout and Girl Scout troops, as well as students from Hood College in Frederick, Maryland. Other areas were planted with a mechanical tree planter and a tractor. In all, 3,600 trees were planted, including: loblolly pine, gray dogwood, silky dogwood, sergeant crabapple, white ash, green ash, black walnut, sawtooth oak, Maryland alder, river birch, yellow

poplar, sycamore, redbud, hackberry and pin oak. The seedlings are being cared for in different ways. The seedlings planted by volunteers are in tree shelters, and a few sections are being kept free of competing vegetation by mowing. Two sections of conifers are being sprayed with an herbicide. In addition to the buffer planting, two livestock watering facilities were also installed as part of this project. One watering facility is a 400-gallon gravity fed trough that utilizes a spring development. The other is a 400-gallon trough fed by a well through a solar-powered electric pump. Two stream crossings are present in this buffer demonstration area; one crossing was recently constructed, and the other already existed. These crossings give cattle and machinery access to all the pastures without causing streambank erosion. There are plans to further improve the demonstration area by fencing and installing crossings on the remaining spring and streams. Rotational intensive grazing and pasture rehabilitation may also be introduced.

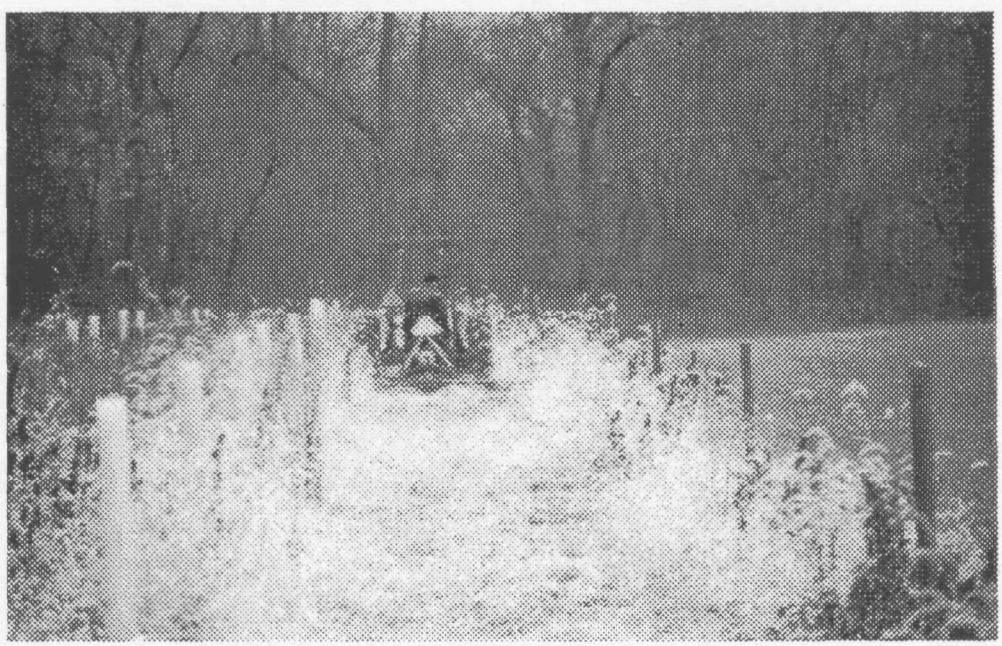
According to the MD Department of Natural Resources Forest Inventory, there is a maximum of 85,000 acres of cropland in Maryland that could be converted to forest buffers.

Monitoring

This site will not be monitored. However, the tree survival rate will be assessed by MD Department of Natural Resources Forest Service. The current survival rate is 70 percent.

Contact:

Patricia Feely
MD DNR Forest Service
(301) 473-8417



ST. LEONARD'S FARM, VA

Background

St. Leonard's Farm, a 330-acre cattle field in Warrenton, Virginia, is located on Great Run, a tributary of the Rappahannock River. The Rappahannock watershed is spread over 2,848 square miles; 63 percent is forested, 35 percent is covered by cropland, and only 2 percent is urban. Since 35 percent of the land in the Rappahannock basin is used for either pasture or crops, it is not surprising that much of the pollution in the river comes form agricultural runoff such as soil, manure, pesticides and fertilizer. Up the river from St. Leonard's Farm is the Warrenton Waste Water Treatment Plant. Chlorine, bacteria and nutrients, including nitrogen and phosphorous, are some of the pollutants that can enter water from a waste water treatment plant. Over the years, Save Our Streams has monitored the water quality of Great Run and found it to be very poor.

> *"Many blame the pollution of the Bay on farmers. But we all contribute, and this is one way to do something about it and we hope farmers can eventually incorporate the poplar into their daily management."*
>
> **Paddy Katzen**
> **VA Department of Environmental Quality**

The goal of this restoration effort is to test the use of hybrid poplar trees in riparian areas as a method of reducing pollution running into nearby streams. St. Leonard's Farm provides an opportunity for research on the technique of establishing poplar riparian forest buffers. Poplar trees are not only capable of improving water quality and providing wildlife habitat; but the trees are also a valuable cash commodity when harvested. St. Leonard's Farm also provides a site for comparison between poplar and native tree buffers. Establishing poplar riparian forest buffers will provide insight that can be used throughout the Chesapeake Bay region to help farmers decide if poplar riparian forest buffers are applicable on their property.

Project Description

Approximately 1,400 poplar trees were planted in the Spring of 1995 by volunteers from Keep Faquier Clean and Central Elementary School. Five hundred four-to-five foot hybrid poplar trees were planted 3 X 12' apart in three rows on both sides of the stream. Three different kinds of five-foot hybrids were planted, including: 200 androscoggin poplar, 150 red caudina and 150 charkowiensis

incrassata. In addition, 400 unrooted 12-inch cuttings of androscoggin poplar were planted, as well as 250 Imperial Carolina poplar. These cuttings were planted in four rows of 2 X 6'. The average width of the buffer is 30' on both sides of the river. Different planting methods were used for this restoration project. Initially the holes for the five-foot trees were dug with a post-hole auger. After that, the preferred method was to use a ditch witch. As a companion project, VA Department of Forestry (DOF) planted 250 river birch, willow oak, green ash and bald cypress at the same Warrenton site.

The St. Leonard's Farm experiment will determine whether a poplar riparian forest buffer will significantly reduce pollution running into Great Run.

Monitoring

Over the next five years, tree growth and stream pollution levels will be measured to determine the poplar's effectiveness at curbing pollution and whether these trees have widespread application to farm runoff. The details of the St. Leonard's monitoring plan are still being discussed. However, the site will definitely be monitored for macroinvertebrates and nitrate levels twice a year. The survival rate will be assessed by volunteers of Keep Faquier Clean, in collaboration with DOF. Presently, the rooted stocks have done quite well; the sticks, however, have experienced problems due to climatic changes.

Contact:

Dennis McCarthy
Virginia Department of Forestry - Warrenton Office
(540) 347-6358

VERDANT VALLEY FARM, MD

Background

Verdant Valley Farm is a 223-acre horse and agricultural farm located in Harford County, through which the Little Gunpowder Falls River flows . Little Gunpowder Falls runs from northern Baltimore County to Days Cove, wh ere it empties into the Chesapeake Bay. The Little Gunpowder Falls provides about 25 miles of habitat supporting brook and brown trout, and much of this area is bordered by Gunpowder Falls State Park.

The headwaters of the Little Gunpowder, in the Monkton area near the Baltimore-Harford County line, flow through heavily grazed and cropped agricultural fields. Consequently, sediment, nitrogen and phosphorous loadings and changes in water temperature that result from increased non-point source pollution have degraded the water quality. The specific objectives of this restoration are moderated water temperature for the trout that inhabit the stream and improved wildlife habitat for the Farm's numerous species of migratory waterfowl.

> ***"We can already see the good effects. There are birds out there that we never saw before."***
>
> ***James Easter***
> ***Landowner***

The Verdant Valley Farm restoration is part of the Little Gunpowder Falls Restoration Project, one of the most extensive watershed restoration efforts undertaken on private land in the state of Maryland. This project is being funded with the help of the Federal Forest Stewardship Incentive Program (SIP) and the Maryland Department of Natural Resources' Greenshores Buffer Incentive Program (BIP). SIP pays 65 percent of certain improvement costs, while BIP pays between $300 and $500 per acre of improvement.

Project Description

At the Verdant Valley Farm, three acres of pasture land was restored along the Little Gunpowder Falls in 1993. One thousand seedlings of the following varieties were planted: sycamore, black walnut, pin oak, green ash and white ash. The seedlings were spaced 12' X 12' and were planted by a private contractor.

The riparian forest buffer measures 50' wide and travels 3,000 linear feet along the Harford County side of Little Gunpowder Falls. Only one side of the stream was planted because the other side was already established with woody vegetation. Since one row of woody vegetation was already present along the streambanks, bank stabilization was not needed. A survival inspection was completed in the Fall of 1993 at the Verdant Farm, at which time it was determined there was a need for reinforcement. Consequently, replantings with the same species used in 1993 were conducted in 1994. Due to buck rubs and flood damage, the plantings were reinforced again in 1996.

Monitoring

The Verdant Valley Farm will not be monitored. However, the survival rate will be assessed by MD Department of Natural Resources Forest Service. Presently, the trees are roughly 1" in diameter and 8' high.

Contact:

Michael Huneke
Maryland Department of Natural Resources Forest Service
(410) 836-4551

WALKERSVILLE HERITAGE FARM PARK, MD

Background

The Walkersville Heritage Farm Park Forest Buffer Nature Trail is located on Devilbiss Bridge Road along Glade Creek in Walkersville, Maryland. Glade Creek is a tributary of the Mononacy River, the largest Maryland tributary to the Potomac River. The Mononacy River forms near the Maryland-Pennsylvania border west of Harney, Maryland, at the confluence of Marsh and Rock Creeks. The Monocacy watershed encompasses 774 square miles, or 476,200 acres, of which 75 percent is in the state of Maryland and the rest in Pennsylvania. Roughly three-quarters of the land in the watershed has been cleared for agriculture and currently supports about 3,500 farms, each averaging 150 acres. However, the Monocacy watershed is quickly evolving from an agricultural to a suburban landscape.

Wildlife habitat is greatly enhanced by riparian forest buffers. Trees, shrubs, grasses and the transition from aquatic to upland habitats are critical in the life stages of over ½ of all native Bay species.

The Walkersville Heritage Farm Park was targeted for riparian forest buffer restoration because of the severely degraded water quality in Glade Creek. Another objective of the project is improved wildlife habitat. Prior to the planting, the park mowed the fields.

A buffer trail and brochure have been developed for visitors to the Walkersville Heritage Farm Park to follow a self-guided trail and learn about trees and wildlife along the way. The ⅓ mile handicapped-accessible loop contains two foot bridges and sixteen informative steps as it winds its way along Glade Creek.

Project Description

The riparian forest buffer planting and bridge construction were completed in 1990. At that time, roughly two acres of vegetation were hand planted by volunteers. The riparian forest buffer protects both sides of Glade Creek for approximately 900 linear feet. The average width of the riparian buffer is 100'. The species planted included sycamore, river birch, tulip poplar, red maple, green ash, red oak, blackgum, hackberry, spicebush, silky dogwood, red bud, white pine, black walnut, yellow poplar and pin oak.

The ground between the trees in the buffer is mowed to about ¼" because of public pressure. A 2-5' buffer of dense silky dogwood exists between the creek bank and the mowed area. The most impressive part of this area is the growth rate of the trees; many of them are 20' tall and 4" in diameter. The possibility exists to extend the riparian forest buffer downstream as the land on either side of Glade Creek becomes high density subdivisions.

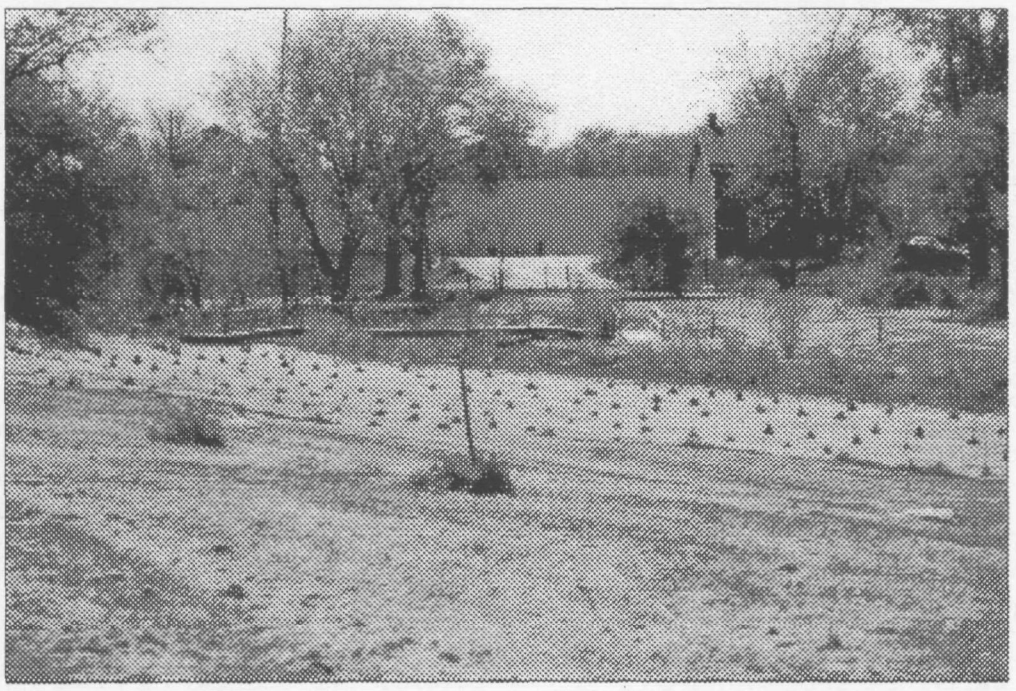
Areas covered with trees and shrubs absorb 14 times more rainfall than a mowed lawn.

Monitoring

The Forest Buffer Nature Trail at the Walkersville Heritage Farm Park will not be monitored. However, the survival rate will be assessed by the Town of Walkersville and the Maryland Department of Natural Resources Forest Service. Presently, the survival rate is assessed at 80 percent.

Contact:

Patricia Feely
Maryland Department of Natural Resources Forest Service
(301) 473-8417



WILLOW OAKS FARM, MD

Background

Willow Oaks Farm is an 800-acre privately owned farm with 300 head of cattle. This farm, through which the Little Gunpowder Falls flows, is located in Jarrettsville Pike, Maryland, at the Baltimore-Harford county line. Little Gunpowder Falls runs from northern Baltimore County to Days Cove, where it empties into the Chesapeake Bay. Little Gunpowder Falls provides about 25 miles of habitat supporting brook and brown trout, and much of this area is bordered by Gunpowder Falls State Park.

The headwaters of the Little Gunpowder Falls flow through heavily grazed and cropped agricultural fields. Sediment, nitrogen and phosphorous loadings and the change in water temperature that results from increased non-point source pollution has degraded the water quality of this stream. The specific goals of this restoration are stabilized streambanks and improved water quality, which will benefit the trout that inhabit the stream, and enhanced wildlife habitat for numerous species of migratory waterfowl.

> ***"My dream is that one day I will stand up on this hill and overlook trees all along the stream and know that there are birds in those trees and fish in that water."***
>
> ***Gerald Stautberg***
> ***Landowner***

The Willow Oaks Farm restoration effort is part of the most extensive watershed restoration effort on private land undertaken in the state. The project will cost more than $14,000, with $11,000 being returned to the landowners through the Federal Stewardship Improvement Program (SIP) and the state Department of Natural Resources Buffer Improvement Program (BIP). SIP pays 65 percent of the costs, while BIP pays between $300 to $500 per acre of improvements.

Project Description

At the Willow Oaks Farm, 18.5 acres of pasture land was restored along more than two linear miles of the Little Gunpowder. About 8,500 bare-root tree seedlings including 3,000 sycamore, 3,200 black walnut, 1,900 green ash and 400 red osier dogwoods have been planted. When grown, the trees will form a 50' wide buffer between the cattle and water, which will prevent 17,500 pounds of nitrogen and 2,500 pounds of phosphorous from entering the waterways each year. In addition,

about 5,000 willow posts and ships are being used to stabilize the streambank. These willows are fast growers and deep rooting, which makes them ideal for anchoring high erosion areas of the property. In addition to the streambank stabilization and buffer reforestation, nearly 4 linear miles of high-tensile fencing was installed on the property to keep cattle from grazing in the water. Three cement crossings and one non-cement crossing for cattle are also being installed to prevent livestock waste from entering the stream. In the spring of 1996, an additional fencing and planting of 15 acres was completed along the Yellow Branch, a tributary of Little Gunpowder Falls, which also flows through the Willow Oaks Farm property. A reinforcement of this Yellow Branch planting with sycamore, black walnut, and green ash seedlings is planned for the spring of 1997. When this project is compete, over 30 acres of forest buffer along Little Gunpowder Falls and Yellow Branch will have been reforested.

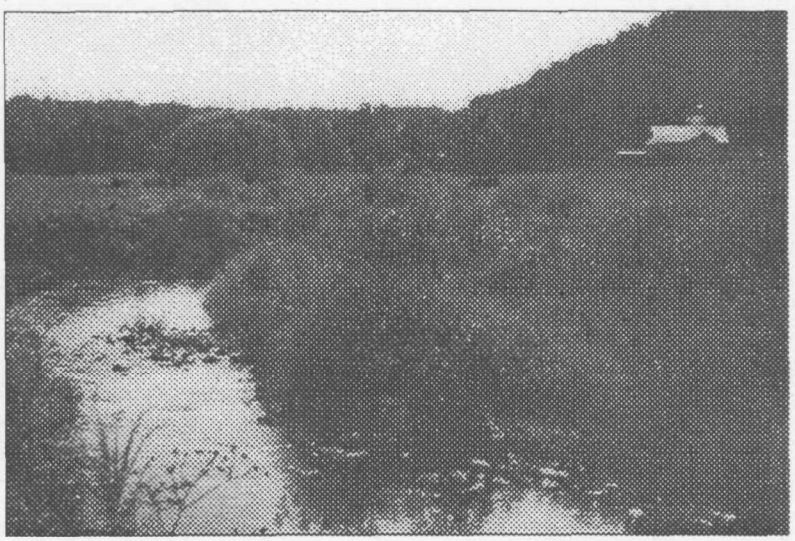
> *"This is the most significant riparian restoration the Maryland Forest Service has ever undertaken."*
>
> *Mike Huneke*
> *Watershed Forester, MD DNR - Forest Service*

Monitoring

This site will not be monitored; however, the survival rate will be assessed by MD Department of Natural Resources Forest Service. Presently, the survival rate is assessed at 80 percent.

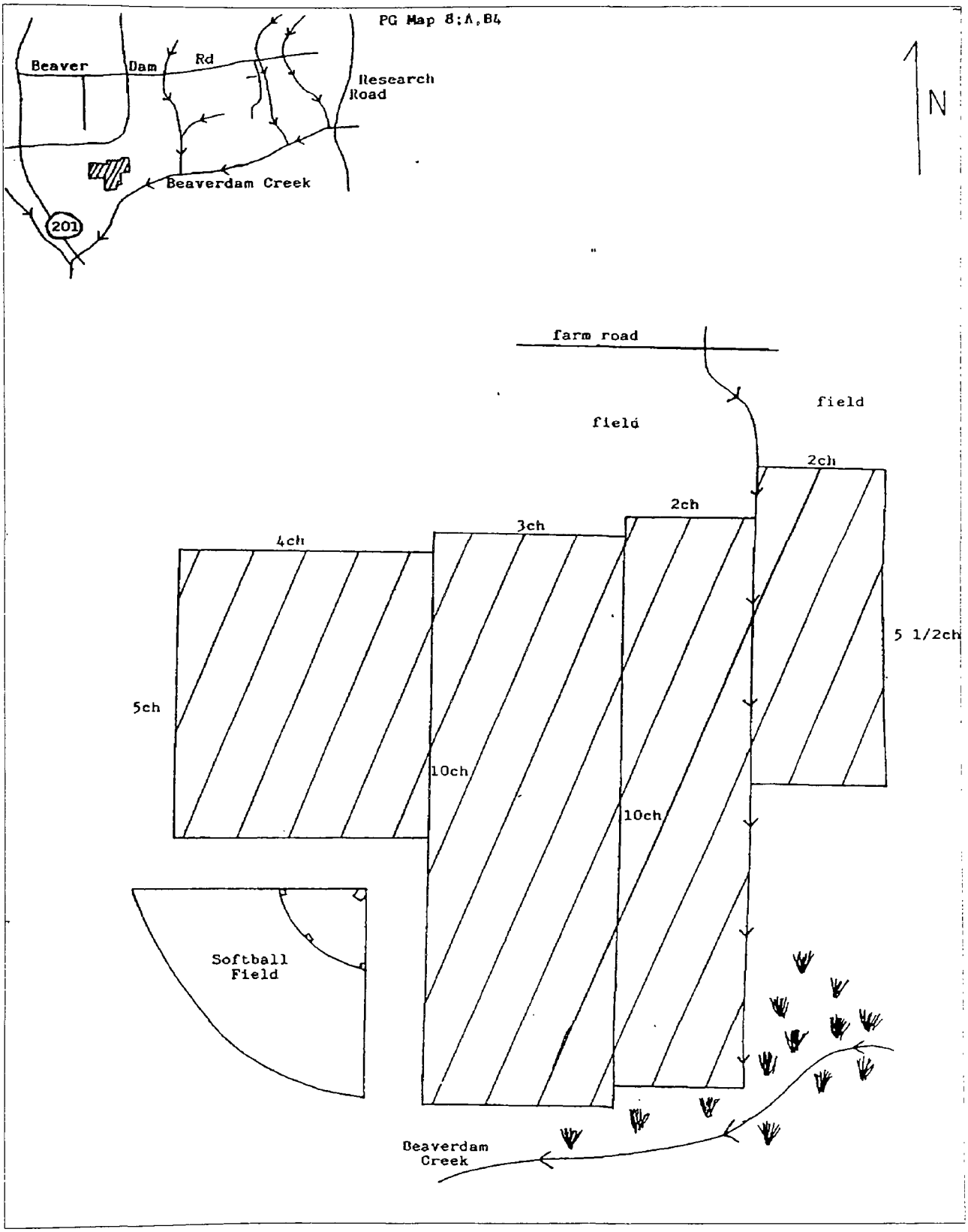
Contact:

Michael Huneke
Maryland Department of Natural Resources Forest Service
(410) 836-4551

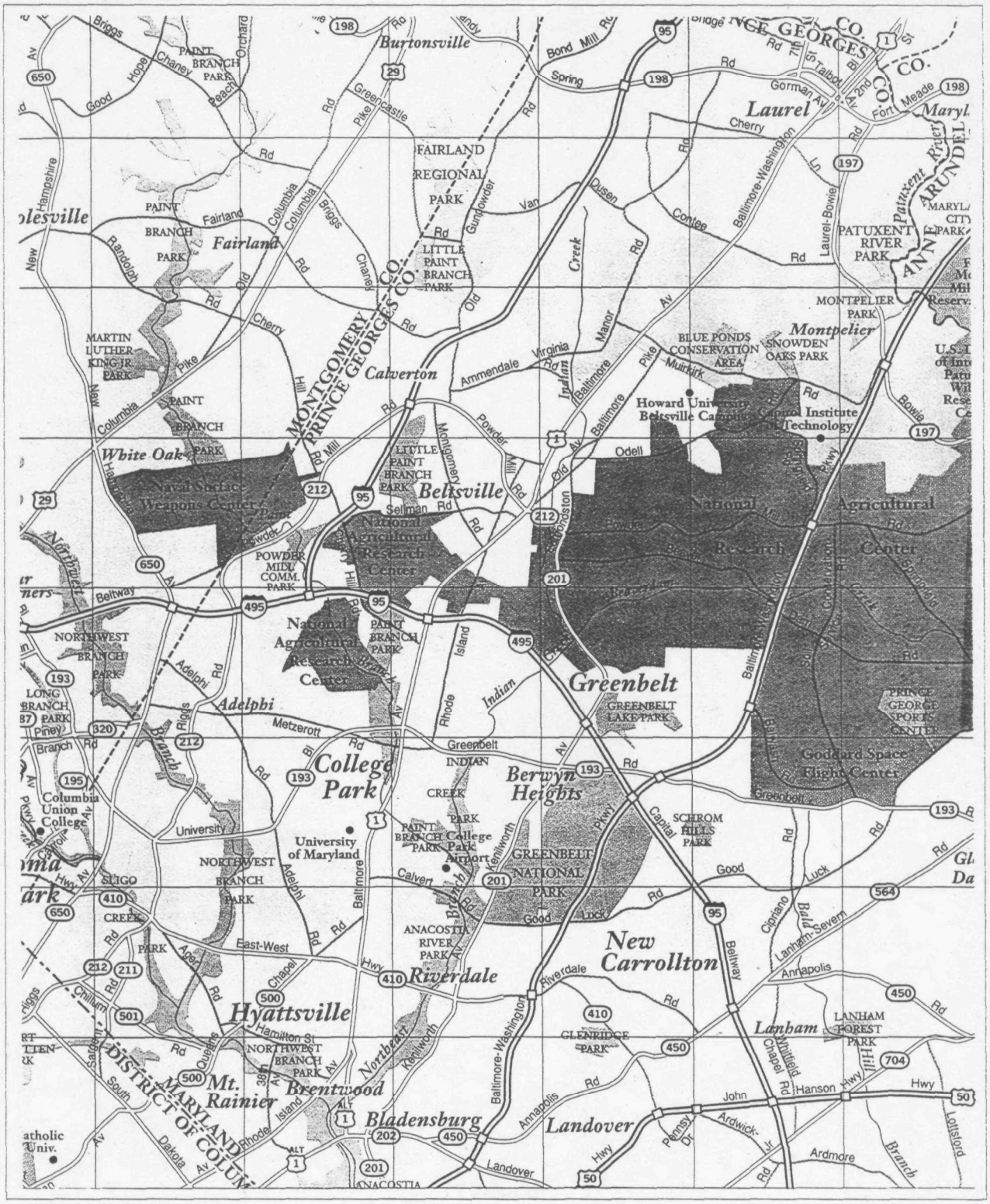


APPENDIX I:
MAPS TO THE RESTORATION SITES

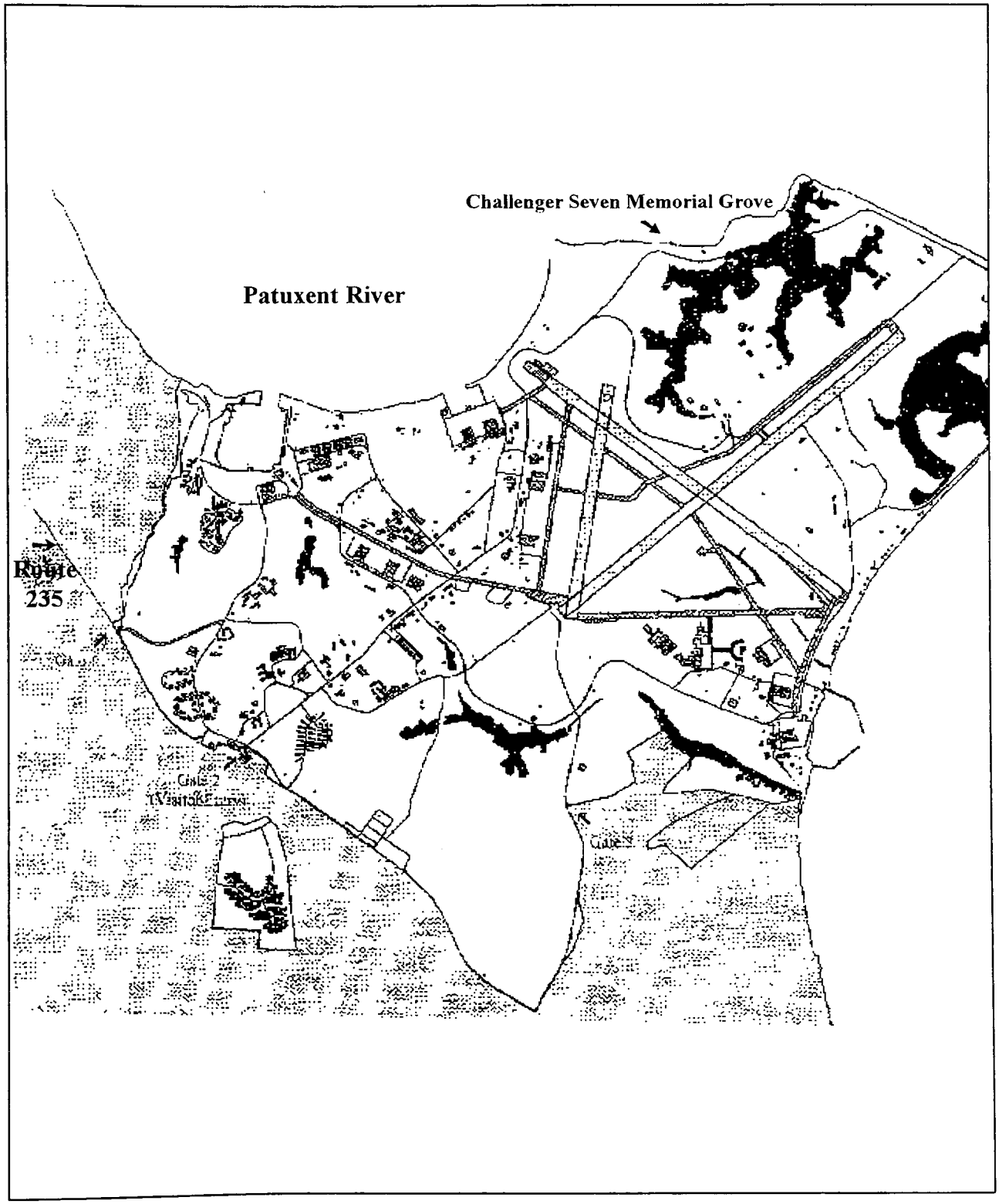
BEAVERDAM CREEK



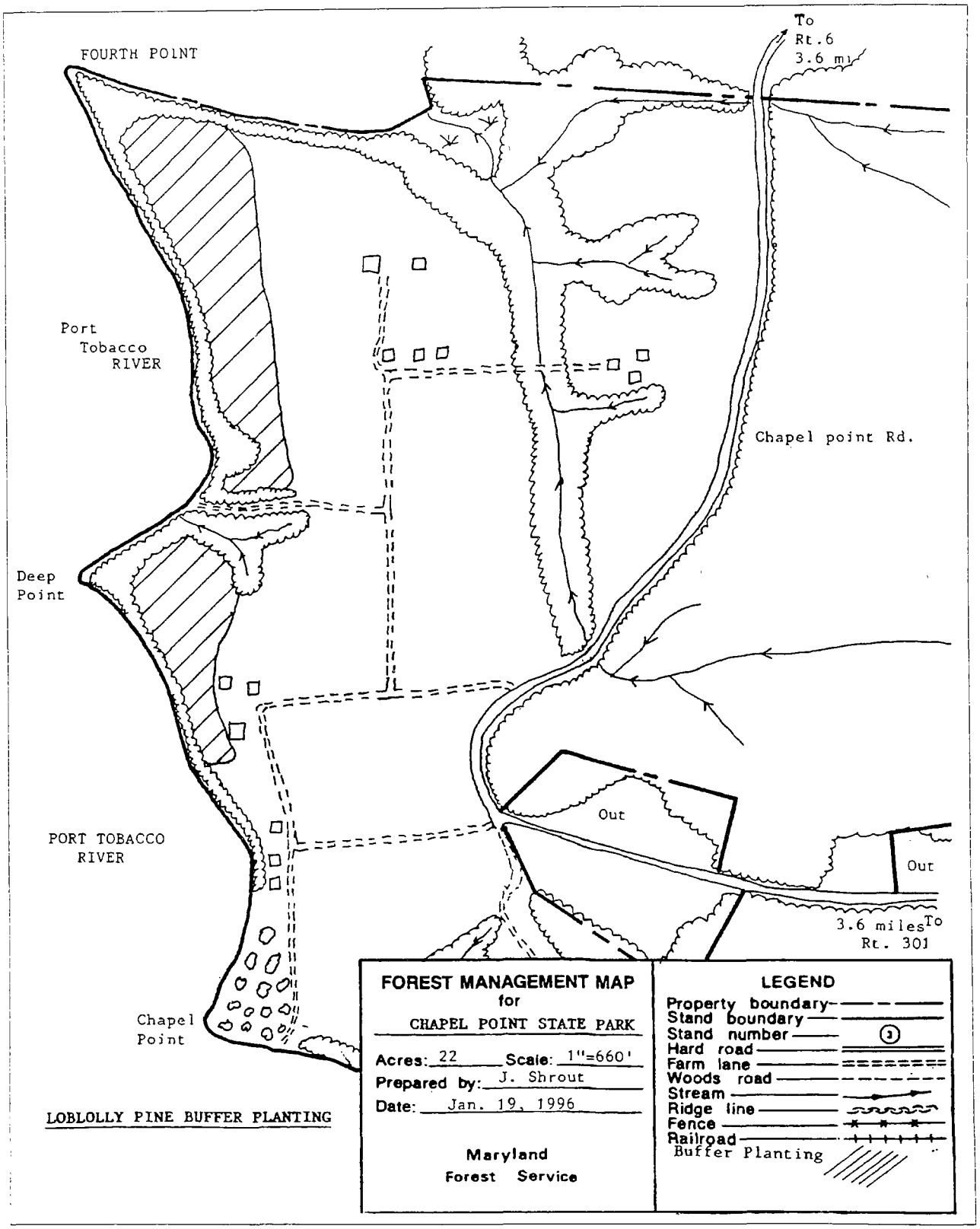
BELTSVILLE AGRICULTURAL RESEARCH CENTER



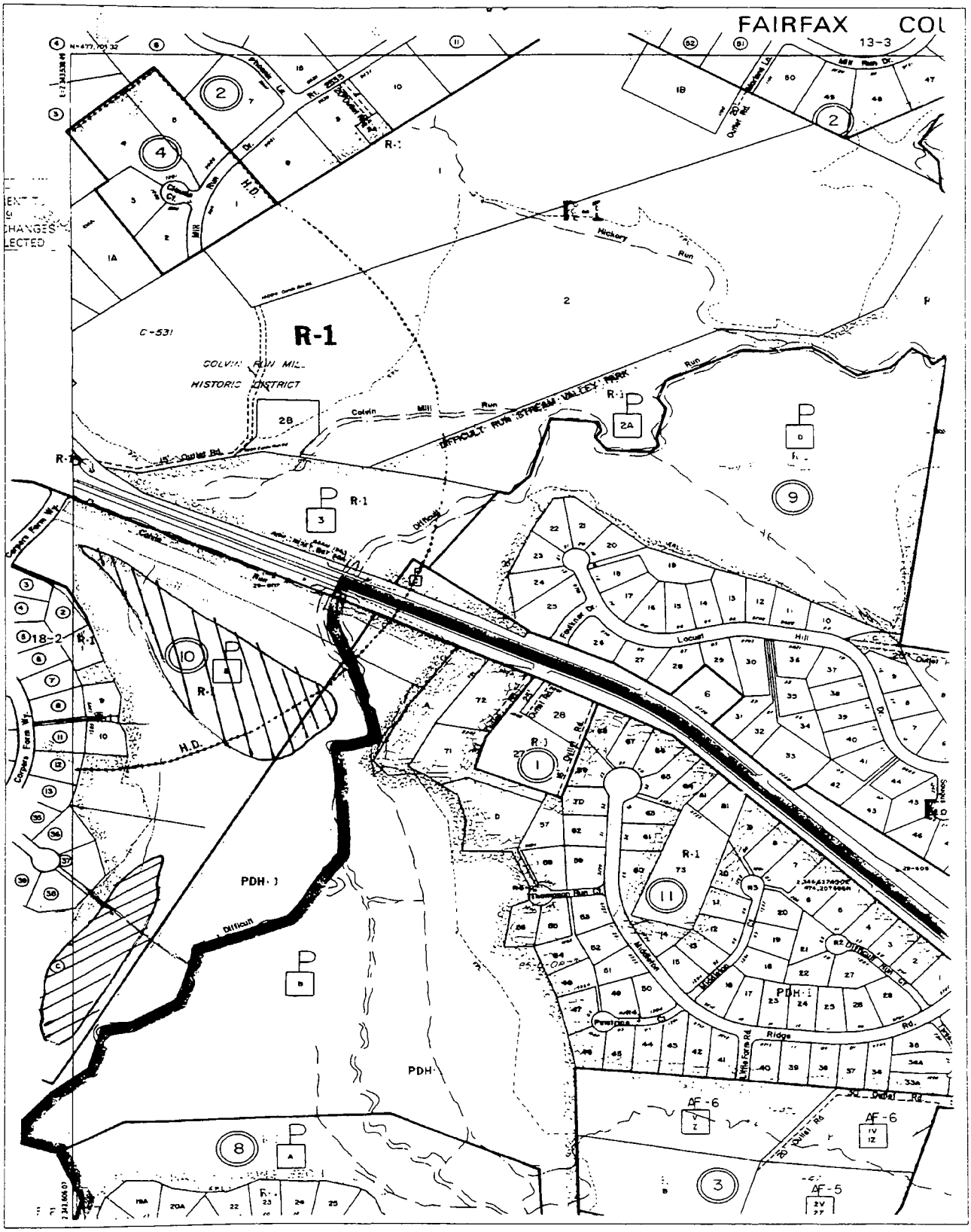
CHALLENGER SEVEN MEMORIAL GROVE



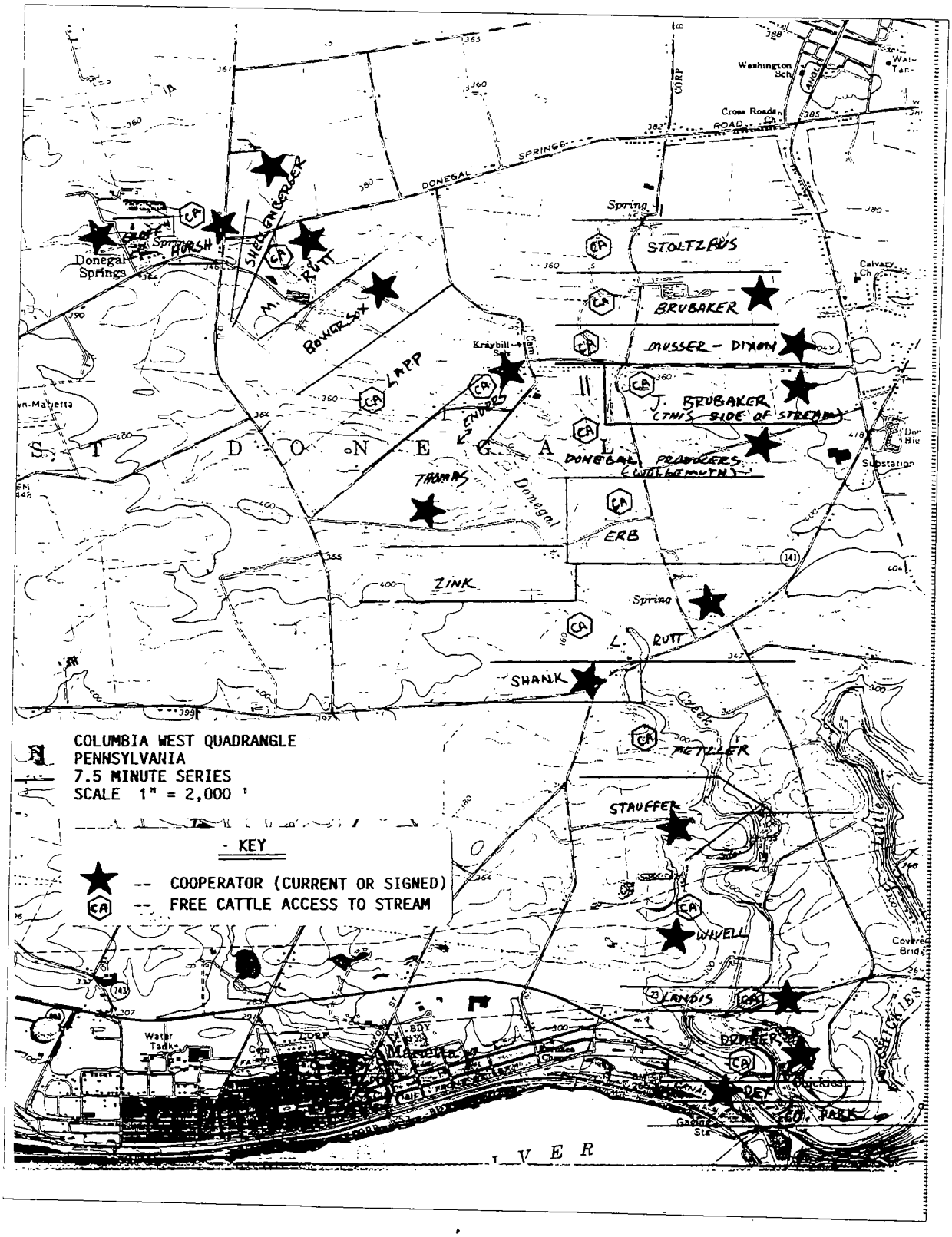
CHAPEL POINT STATE PARK



DIFFICULT RUN

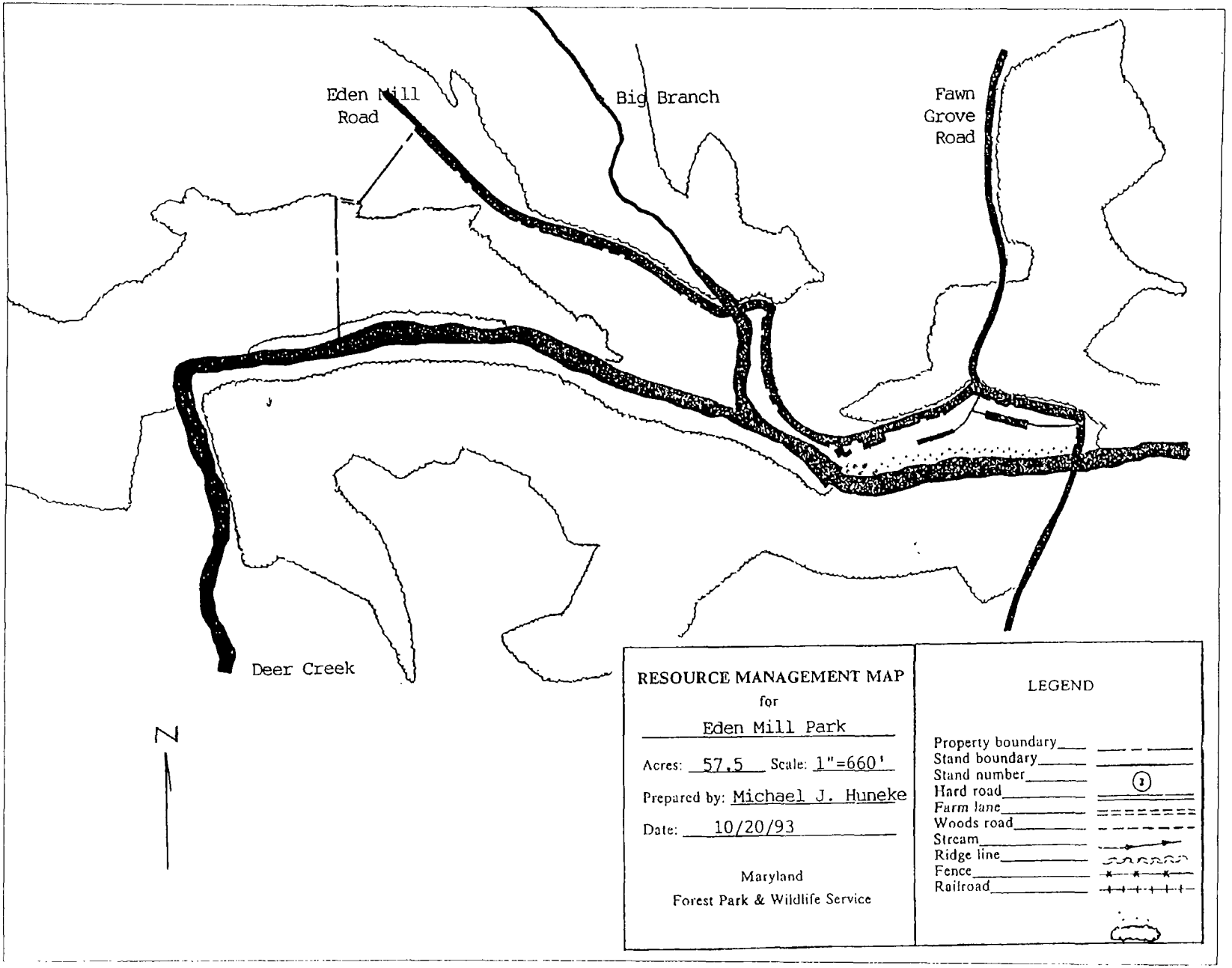


DONEGAL CREEK*

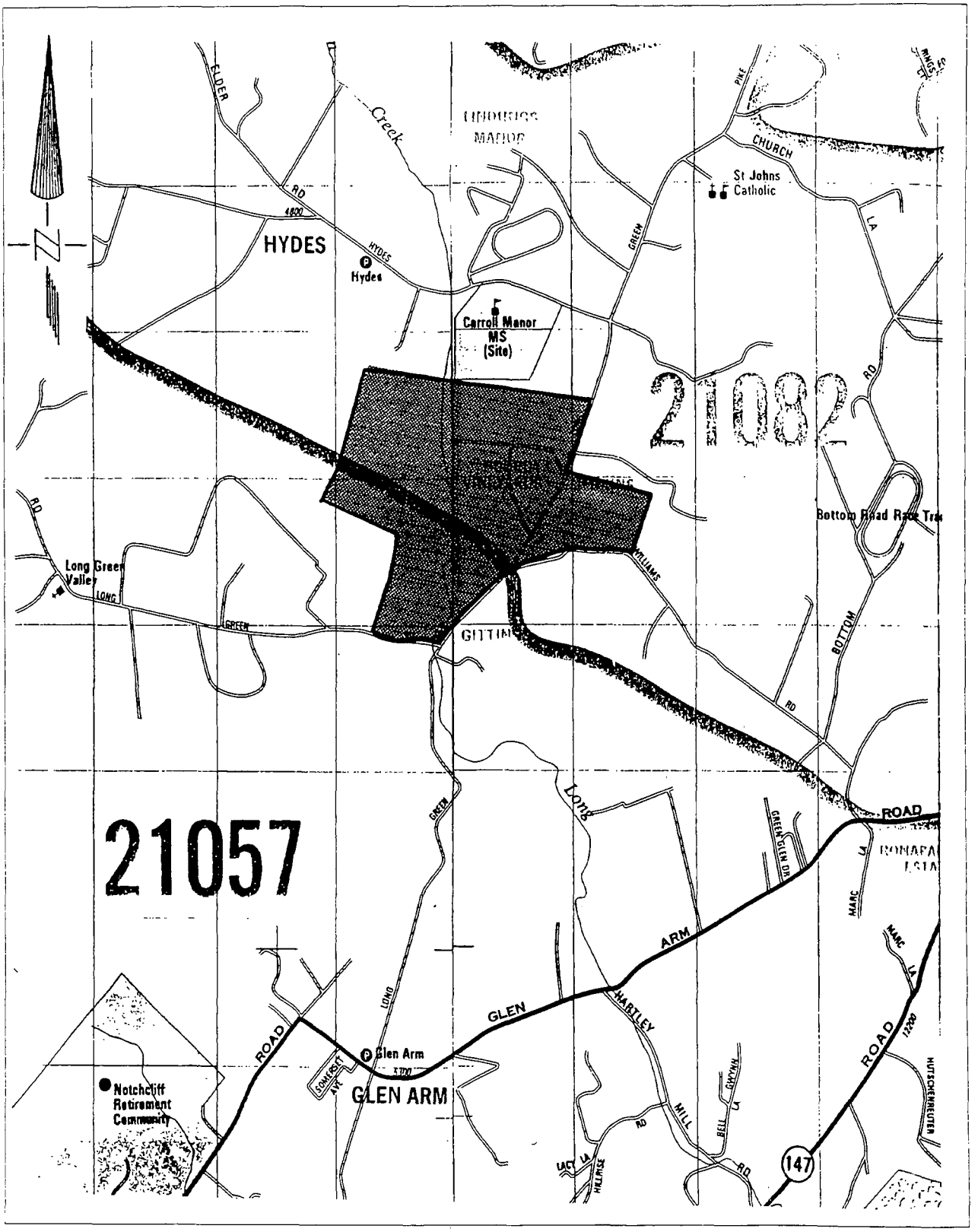


* Shows the Bowersox Farm and Hursh Farm restoration sites

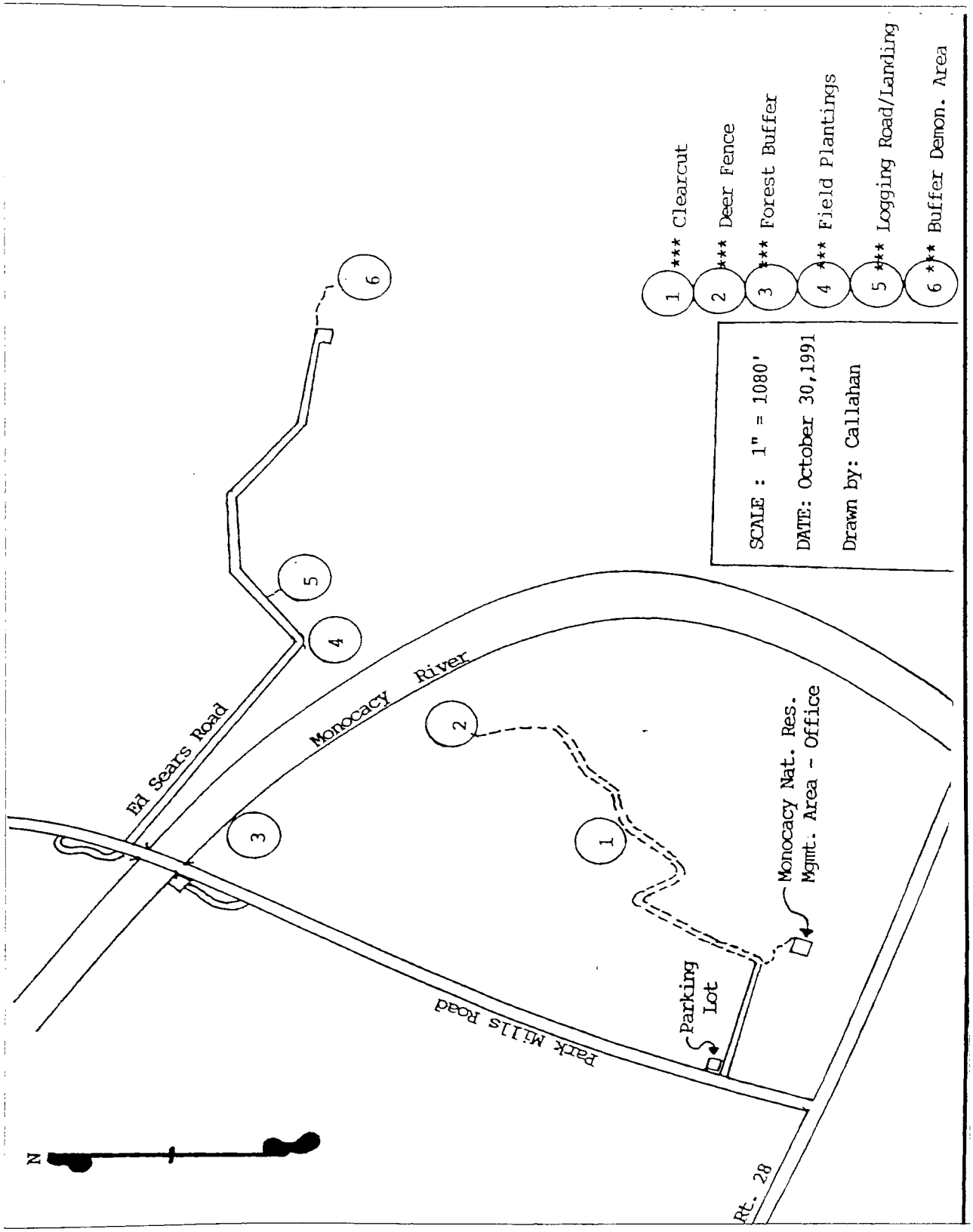
EDEN MILL PARK



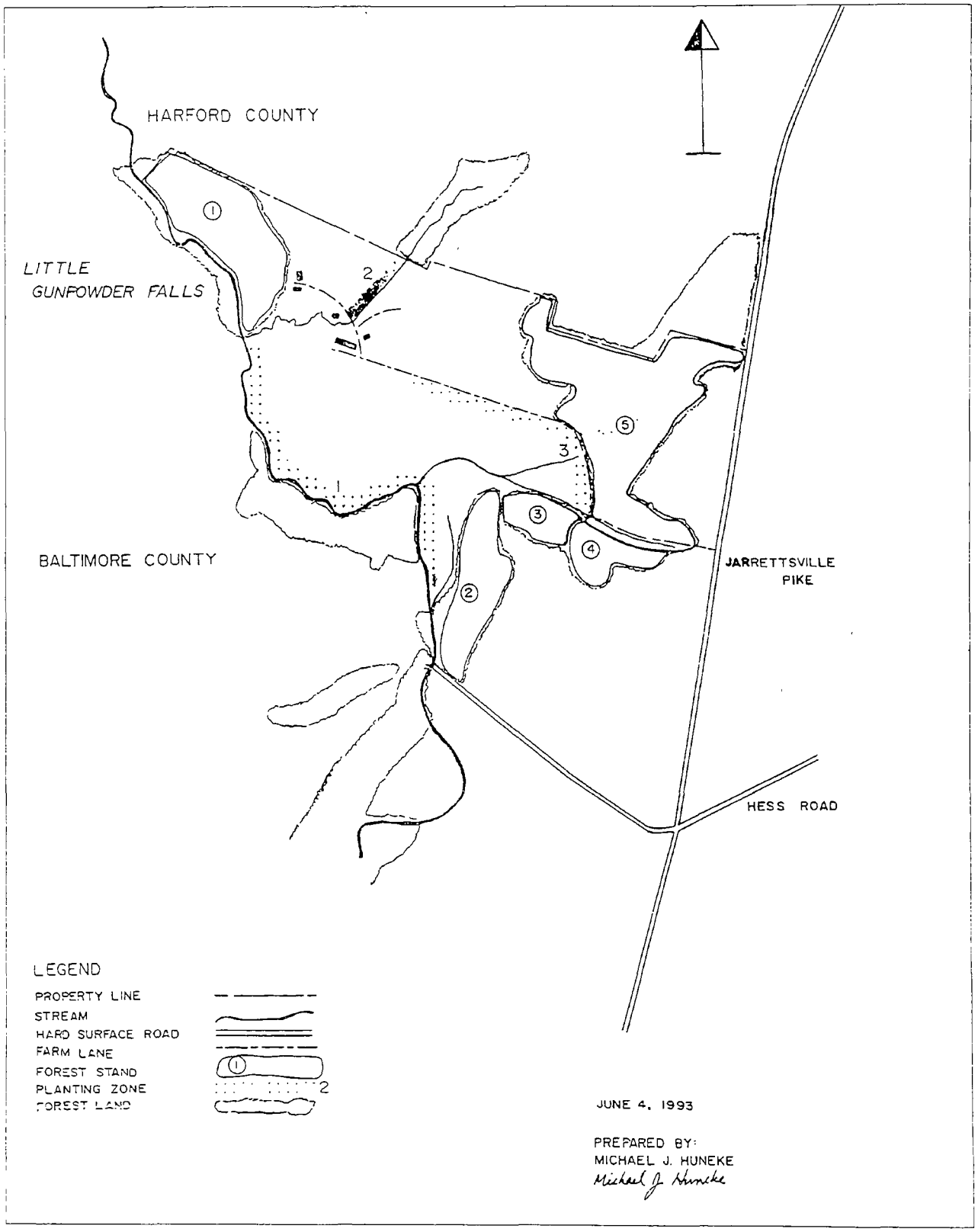
LONG GREEN CREEK



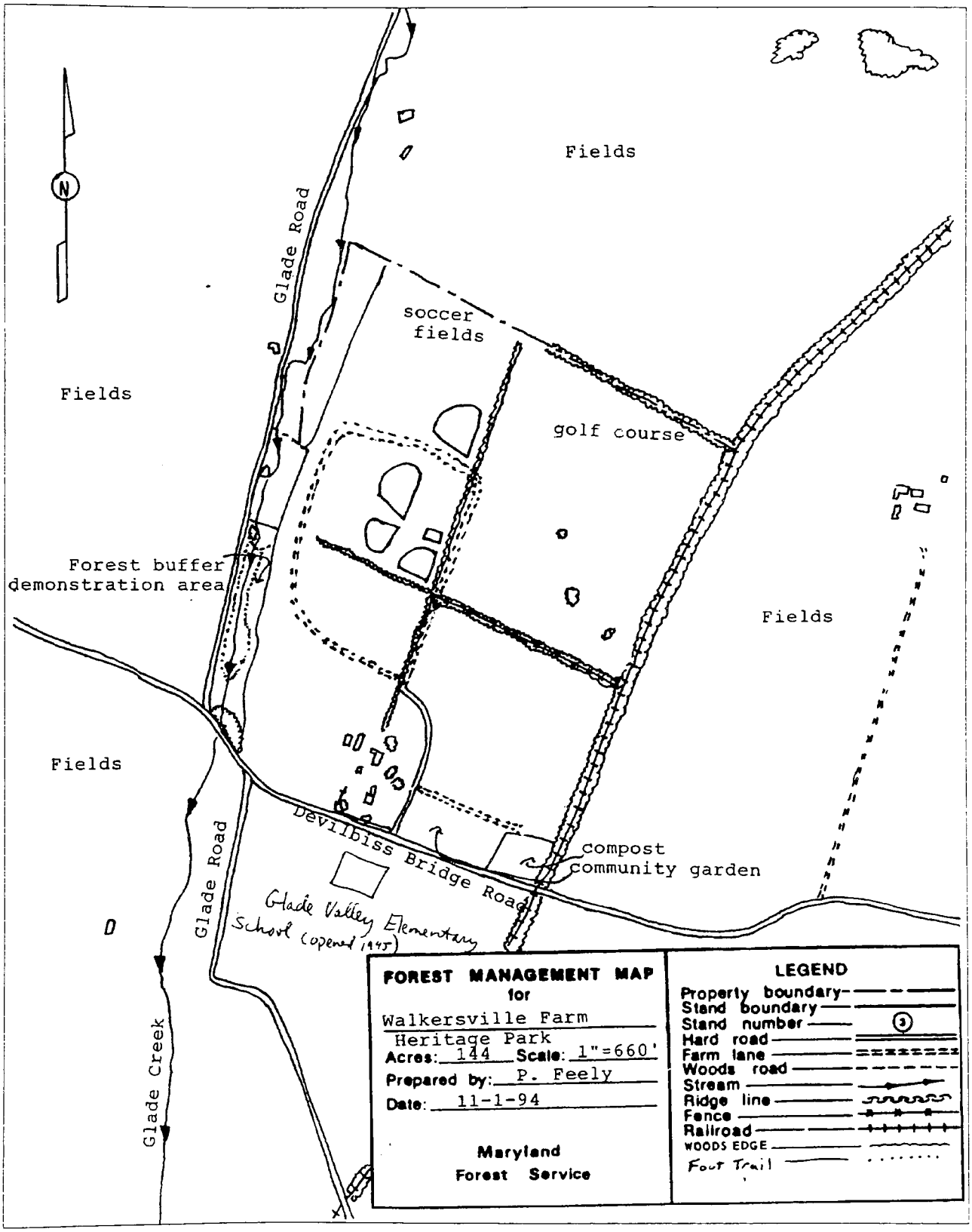
MONOCACY NATURAL RESOURCE AREA



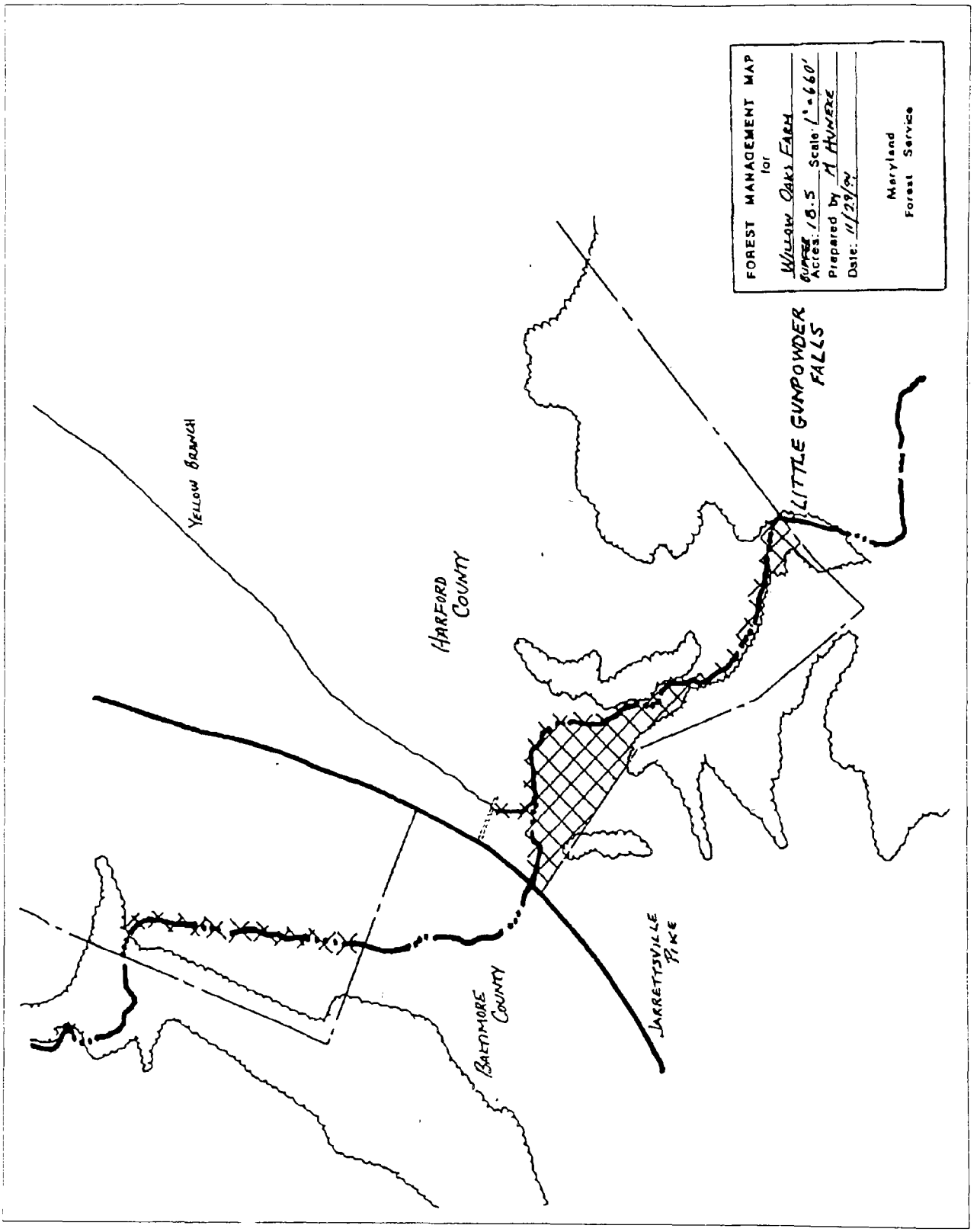
VERDANT VALLEY FARM



WALKERSVILLE FARM HERITAGE PARK



WILLOW OAKS FARM



APPENDIX II:
SOURCES OF ASSISTANCE

SOURCES OF ASSISTANCE

Forested buffers can be used in both rural and urbanized areas to improve water quality and wildlife habitat and stabilize streambanks. Forested buffers are most effective when used in combination with other conservation measures that address nutrient management, runoff and erosion control. Prior to creating the forested buffer, seek the assistance of technical experts who will help you evaluate important factors, including:

- the immediate and long term goals of this site;
- which vegetation, if any, should be removed;
- the characteristics of the waterway, including its age, water flow and soil conditions, and
- how to reduce costs.

If you are a streamside landowner, establishing a forested buffer will help you save soil, improve wildlife habitat and protect water quality. Streamside landowners who develop improved land management plans, including the use of forested buffers, fencing and other Best Management Practices, may be eligible for cost-share assistance through a variety of sources.

For more information please contact:

Chesapeake Bay Program
410 Severn Avenue, Suite 109
Annapolis, MD 21403
(800) YOUR BAY

Alliance for the Chesapeake Bay (MD Office)
6600 York Road, Suite 100
Baltimore, MD 21212
(410) 377-6270

Alliance for the Chesapeake Bay (PA Office)
225 Pine Street
Harrisburg, PA 17101
(717) 236-9019

Alliance for the Chesapeake Bay (VA Office)
P.O. Box 1981
Richmond, VA 23218
(804) 775-0951

Or your State Forestry Agency Representatives:

Pennsylvania Bureau of Forestry
P.O. Box 8552
Harrisburg, PA 17105
(717) 787-2106

Maryland Department of Natural Resources Forest Service
Tawes State Office Building, E-1
Annapolis, MD 21401
(410) 974-3776

Virginia Department of Forestry
P.O. Box 3758
Charlottesville, VA 22903
(804) 977-6555

If you would like to have a project of yours included this guide, please send a short description and detailed planting and location information along with the name, address, and phone number of the contact person to:

Chesapeake Bay Program
Forestry Workgroup Fellow
410 Severn Avenue, Suite 109
Annapolis, MD 21403
(410) 267-5700 (telephone)
(410) 267-5777 (fax)