



United States
Department of
Agriculture

Natural
Resources
Conservation
Service

Richmond,
Virginia

Buena Vista Watershed

Final Plan-Environmental Impact Statement

City of Buena Vista
Rockbridge County, Virginia



January 1999

ADDENDUM

Buena Vista Watershed

Rockbridge County, Virginia

This addendum shows project costs and benefits updated to a December, 1998 price base and includes the change in the discount rate from 7.125% in FY98 to 6.875% for FY99.

1. Project costs currently are estimated to be:
 - a) Amortized installation: \$409,000
 - b) Annual operation and maintenance: \$38,000

2. Project benefits are currently estimated to be:
 - a) Total annual benefits for 55 years: \$670,000

3. The revised estimated project benefit-cost ratio is: 1.50 : 1.00

WATERSHED PLAN and ENVIRONMENTAL IMPACT STATEMENT

BUENA VISTA WATERSHED

City of Buena Vista and Rockbridge County, Virginia

ABSTRACT:

This document describes a plan to reduce flood damages in the Buena Vista Watershed. The recommended plan consists of multiple works of improvement including the following measures: the construction of seven debris basins; replace/enlarge/remove seven culverts and/or bridges; construct 500 feet of concrete floodwall and upgrade 220 feet of earthen berm; improve 5,538 feet of stream channel; realign and improve 120 feet of stream channel; replace two railroad bridges on Indian Gap Run with five box culverts; and replace the railroad culvert on Pedlar Gap with two box culverts. The primary effects of the plan are to reduce damages from flooding caused by four streams (Chalk Mine Run, Indian Gap Run, Noel's Run, which is sometimes referred to as Reservoir Hollow, and Pedlar Gap Run) that run through the City of Buena Vista. This document is intended to meet the requirements of the National Environmental Policy Act and to be considered for authorization of Public Law 83-566 funding. This plan was prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16 U.S.C. 1001-1008) and in accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 U.S.C. 43121 et seq.).

Sponsors

Natural Bridge Soil and Water Conservation District
City of Buena Vista

January 1999

For further information, please contact:

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WATERSHED AGREEMENT

between the

Buena Vista Town Council, Virginia
Natural Bridge Soil and Water Conservation District
(Referred to herein as Sponsors)

State of Virginia

and the

Natural Resources Conservation Service
U.S. Department of Agriculture
(Referred to herein as NRCS)

Whereas, application has heretofore been made to the Secretary of Agriculture by Sponsors for assistance in preparing a plan of works of improvement for the Buena Vista Watershed, State of Virginia, under the authority of the Watershed Protection and Flood Prevention Act (16 U.S.C. 1001-1008); and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to NRCS; and

Whereas, there has been developed through the cooperative efforts of the Sponsors and NRCS a plan for works of improvement for the Buena Vista Watershed, State of Virginia, hereinafter referred to as the Plan, which Plan is annexed to and made a part of this agreement:

Now, therefore, in view of the foregoing considerations, the Secretary of Agriculture, through NRCS, and the Sponsors hereby agree on this Plan and that the works of improvement for this project will be installed, operated, and maintained in accordance with the terms, conditions, and stipulations provided for in this Plan and including the following:

1. The Buena Vista Town Council will acquire, with other than Public Law 83-566 funds, such real property as will be needed in connection with the works of improvements. (Estimated cost is \$419,000).

2. The Sponsors hereby agree that they will comply with all of the policies and procedures of the Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 U.S.C. 4601 et. seq. as implemented by 7 C.F.R. Part 21) when acquiring real property interests for this federally assisted project. If the Sponsors are legally unable to comply with the real property acquisition requirements of the Act, it agrees that, before any Federal financial assistance is furnished, it will provide a statement to that effect, supported by an opinion of the chief legal officer of the state containing a full discussion of the facts and law involved. This statement may be accepted as constituting compliance. In any event, the Sponsors agree that they will reimburse owners for necessary expenses as specified in 7 C.F.R. 21, 1006 (c) and 21.1007.

The cost of relocation payments in connection with the displacements under the Uniform Act will be shared by the Sponsors and NRCS as follows:

	Sponsors %	NRCS %	Estimated relocation payment costs \$
Relocation Payments*	0	100	\$0

* Investigation of the watershed project area indicates that no displacements will be involved under present conditions. However, in the event that displacement becomes necessary at a later date, the cost of relocation assistance and payments will be cost shared in accordance with the percentages shown.

3. The Sponsors will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to State law as may be needed in the installation and operation of the works of improvement.

4. The Sponsors will obtain all necessary Federal, State, and local permits required by law, ordinance, or regulation for installation of the works of improvement.

5. The percentages of construction costs to be paid by the Sponsors and by NRCS are as follows:

Works of Improvement	Sponsors 0%	NRCS 100%	Estimated Construction Costs \$5,420,000
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6. The percentages of the engineering services costs to be borne by the Sponsors and NRCS are as follows:

	Sponsors	NRCS	Estimated engineering services costs
A&E Design Services	0%	100%	\$435,000*
NRCS Engineering Design Services	0%	100%	\$80,000
NRCS Construction Inspection	0%	100%	\$225,000
Construction Inspection**			

* Architectural and Engineering design costs for bridges, culverts and some channel improvements.

** The Sponsors will bear the cost of construction inspection that they incur.

7. The Sponsors and NRCS will each bear the costs of project administration that each incurs, estimated to be \$100,000 (includes \$60,000 for local technical assistance) and \$145,000, respectively.

8. The Sponsors agree to participate in and comply with applicable Federal floodplain management and flood insurance programs before construction begins.

9. The Sponsors will be responsible for the operation, maintenance, and any needed replacement of the works of improvement by actually performing the work or arranging for such work, in accordance with agreements to be entered into before issuing invitations to bid for construction work.

10. The costs shown in this plan are preliminary estimates. Final costs to be borne by the parties hereto, will be the costs incurred in the installation of works of improvement.

11. This agreement is not a fund-obligating document. Financial and other assistance to be furnished by NRCS in carrying out the plan is contingent upon the fulfillment of applicable laws and regulations and the availability of appropriations for this purpose.

12. A separate agreement will be entered into between NRCS and the Sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. This plan may be amended or revised only by mutual agreement of the parties hereto, except that NRCS may deauthorize or terminate funding at any time it determines that the Sponsors have failed to comply with the conditions of this agreement. In this case, NRCS shall promptly notify the Sponsors in writing of the determination and the reasons for deauthorization of project funding, together with the effective date. Payments made to the Sponsors or recoveries by NRCS shall be in accord with the legal rights and liabilities of the parties when project funding has been deauthorized. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between NRCS and the Sponsors having specific responsibilities for the measure involved.

14. No member of, or delegate to, Congress, or resident commissioner, shall be admitted to any share or part of this Plan, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to the agreement if made with a corporation for its general benefit.

15. The program conducted will be in compliance with the nondiscrimination provisions as contained in Titles VI and VII of the Civil Rights Act of 1964, as amended, the Civil Rights Restoration Act of 1987 (Public Law 100-259) and other nondiscrimination statutes, namely, Section 504 of the Rehabilitation Act of 1973, Title IX of the Education Amendments of 1972, the Age Discrimination Act of 1975, and in accordance with regulations of the Secretary of Agriculture (7 C.F.R. 15, Subparts A & B), which provide that no person in the United States shall, on the grounds of race, color, national origin, age, sex, religion, marital status, or handicap be excluded from participating in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving Federal financial assistance from the Department of Agriculture or any agency thereof.

16. Certification Regarding Drug-Free Workplace Requirements (7 CFR 3017, Subpart F).

By signing this watershed agreement, the sponsors are providing the certification set out below. If it is later determined that the sponsors knowingly rendered a false certification, or otherwise violated the requirements of the Drug Free Workplace Act, the NRCS, in addition to any other remedies available to the Federal Government, may take action authorized under the Drug-Free Workplace Act.

Controlled Substance means a controlled substance in Schedules I through V of the Controlled Substances Act (21 U.S.C. 812) and as further defined by regulation (21 CFR 1308.11 through 1308.15);

Conviction means a finding of (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statutes;

Criminal drug statute means a Federal or non-Federal criminal statute involving the manufacturing, distribution, dispensing, use, or possession of any controlled substance;

Employee means the employee of a grantee directly engaged in the performance of work under a grant, including: (i) all direct charge employees; (ii) all indirect charge employees unless their impact or involvement is insignificant to the performance of the grant; and, (iii) temporary personnel and

consultants who are directly engaged in the performance of work under the grant and who are on the grantee's payroll. This definition does not include workers not on the payroll of the grantee (e.g., volunteers, even if used to meet a matching requirement; consultants or independent contractors not on the grantees' payroll; or employees of subrecipients or subcontractors in covered workplaces).

Certification:

A. The sponsors certify that they will or will continue to provide a drug-free workplace by:

(1) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;

(2) Establishing an ongoing drug-free awareness program to inform employees about--
(a) The danger of drug abuse in the workplace;

(b) The grantee's policy of maintaining a drug-free workplace;

(c) Any available drug counseling, rehabilitation, and employee assistance programs; and

(d) The penalties that may be imposed upon employees for drug abuse violation occurring in the workplace

(3) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (1);

(4) Notifying the employee in the statement required by paragraph (1) that, as a condition of employment under the grant, the employee will--

(a) Abide by the terms of the statement; and

(b) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction;

(5) Notifying the NRCS in writing, within ten calendar days after receiving notice under paragraph (4)(b) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer or other designee on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification number(s) of each affected grant;

(6) Taking on of the following actions, within 30 calendar days of receiving notice under paragraph (4) (b), with respect to any employees who is so convicted--

(a) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or

(b) Requiring such employee to participate satisfactorily in drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency.

(7) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (1),(2),(3),(4),(5),and (6)

B. The sponsors may provide a list of the site(s) for the performance of work done in connection with a specific project of other agreement.

C. Agencies shall keep the original of all disclosure reports in the official files of the agency.

17. Certification Regarding Lobbying (7 CFR 3018).

(1) The sponsors certify to the best of their knowledge and belief, that:

(a) No Federal appropriated funds have been paid or will be paid, by or on behalf of the sponsors, to any person for influencing or attempting to influence an officer or employee of an agency, Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(c) The sponsors shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

(2) This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

18. Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primarily Covered Transactions (7 CFR 3017).

(1) The sponsors certify to the best of their knowledge and belief, that they and their principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency.

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

(2) Where the primary sponsors are unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this agreement.

City of Buena Vista

By: _____
Robert D. Collins

2039 Sycamore Ave., Buena Vista, VA 24416
Address Zip Code

Title: City Manager

Date: _____

The signing of this plan was authorized by a resolution of the _____
governing body of the adopted at a meeting held on _____.

Secretary

Address Zip Code

Date: _____

Natural Bridge Soil and Water Conservation District

By: _____
James A. Carter

30 E. Preston St., Woody Bldg., Lexington, VA 24450
Address Zip Code

Title: Chairman

Date: _____

The signing of this plan was authorized by a resolution of the _____
governing body of the adopted at a meeting held on _____.

Secretary 30 E. Preston St., Woody Bldg., Lexington, VA 24450
Address Zip Code

Date: _____

Natural Resources Conservation Service
United States Department of Agriculture

Approved by:

M. DENISE DOETZER
State Conservationist

Date: _____

**Watershed Plan and Environmental Impact Statement
for
Buena Vista Watershed, Virginia**

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**Watershed Plan and Environmental Impact Statement
for
Buena Vista Watershed
Virginia**

SUMMARY OF WATERSHED PLAN

Project name: Buena Vista Watershed

County: Rockbridge

State: Virginia

City: Buena Vista

Sponsors: City of Buena Vista and the Natural Bridge Soil and Water Conservation District.

Description of recommended plan: This plan reduces flood damages in the Buena Vista Watershed. The recommended plan consists of multiple works of improvement which address stream channel capacity enhancement and debris removal. The primary effects of the plan are to reduce damages from flooding caused by 4 streams (Chalk Mine Run, Indian Gap Run, Noel's Run and Pedlar Gap Run) that run through Buena Vista.

Resource Information:

Size of watershed: 11,850 acres

Land cover- Cropland: None

Grassland: 100 acres

Forest land: 8,900 acres

Urban land: 2,850 acres

Land ownership-Private: 24.2%

City: 1.5%

Federal: 74.3 %

Number of farms- None

Prime and important farmland: None

Project beneficiary profile: There are approximately 800 individuals (12.5% of Buena Vista's population) who live or work within the 100 year floodplain. However, all of Buena Vista's 6,400 residents are considered direct beneficiaries of the project given that the recommended project will reduce future damages, transportation disruptions and associated costs which affect all of Buena Vista's citizens.

Sixteen percent of the resident population is over the age of 65 as compared to 11% for the state-wide average in 1990. Unemployment in 1993 in Buena Vista was at 6.2%. The state-wide rate of unemployment in 1993 was 4.9%. Forty percent of the population over 18 had not graduated from high school, compared to 20% of the residents of Virginia and 17% of the U.S. as a whole. Over 66% of residents within the floodplain who were interviewed in 1992 were below the low to moderate income limits as defined by the HUD income guidelines. In 1989, Buena Vista's per capita income was 58% of the national average (\$10,241 vs. \$17,596) Income levels in 15% of the households of Buena Vista were below the poverty line. Almost 89% of all housing structures in the City were built before 1980. Fifty-six percent of all housing was built before 1960. The median value of homes in Buena Vista is 42,900, while the median value of homes in Virginia is \$90,400.

Wetlands: 2 acres classified as Palustrine unconsolidated bottom, permanently flooded which were man made ponds.

Floodplains: All the floodplain is within Buena Vista and is classified as urban.

Highly erodible cropland: None present

Threatened and endangered species: None present

Cultural resources: Historic sites on the National Register include: Lock #6 of the North River (Kanawha) Canal adjacent to the Maury River; Toll House at lock #5; Indian Gap Run Aqueduct; Lock # 3; Chalk Mine Run Aqueduct; Canal between Maury River and C&O RR; and 3 standing structures in Buena Vista, including buildings on the campus of the Southern Virginia College, at Glen Maury and the old courthouse, are also listed on the National Register. Three archaeological sites were found near the confluence of South Fork and Washer Hollow streams during previous reconnaissance surveys for development of an industrial park. A late 19th/early 20th century iron ore mining site was also discovered during that survey. Two other archaic period Indian campsites are located between the confluence of Pedlar Gap Run and Lowry Run near the Maury River. Old concrete dam/chute structures were found on U.S. Forest Service land in the upstream portions of Indian Gap Run and Noel's Run.

Problem identification: Flooding from 4 interior streams causes overland flow and ponding problems throughout Buena Vista. Flooding problems in the watershed consist of economic losses to streets, bridges, gaslines, waterlines, homes, businesses and industries. Hydrologic and economic studies indicate that a 100-year storm without project protection would flood 245 residences, 70 commercial properties, and many bridges, streets, roads, and utilities resulting in 9.5 million dollars of urban damages. An additional 1.9 million dollars in economic losses result from costs associated with infrastructure repairs and the cleanup of the debris left from the floods.

Alternative plans considered:	Alternative 1 - Stream Channel Capacity Enhancement and Debris Removal - Level I.
	Alternative 2 - Stream Channel Capacity Enhancement and Debris Removal - Level II.
	Alternative 3 - Stream Channel Capacity Enhancement and Debris Removal - Level III.
	Alternative 4 - No Action

Project purpose: Flood prevention

Principal project measures: The recommended plan consists of multiple works of improvement which address stream channel capacity enhancement and debris removal. The measures are as follows: the construction of 7 debris basins; replace/enlarge/remove 7 culverts and/or bridges; construct 500 feet of concrete floodwall and upgrade 220 feet of earthen berm; improve 5,538 feet of stream channel; realign and improve 120 feet of stream channel; replace 2 railroad bridges on Indian Gap Run with 5 box culverts; and replace the railroad culvert on Pedlar Gap with 2 box culverts.

<u>Total Project Costs:</u>	<u>PL 83-566 Funds</u>		<u>Other Funds</u>		<u>Total Funds</u>
Flood prevention	\$6,305,000;	91.1%	\$616,000;	8.9 %	\$6,921,000; 100%
Structural Measures:	\$5,420,000;	100%	\$0;	0%	\$5,420,000; 100%
Construction	\$5,420,000;	100%	\$0;	0%	\$5,420,000; 100%
Other	\$885,000;	59%	\$609,000;	41%	\$1,501,000; 100%
Eng. Services	\$435,000;	100%	\$0;	0%	\$435,000; 100%
Technical Assist.	\$305,000;	83.6%	\$60,000;	16.4%	\$365,000; 100%
Utilities Relocation	\$0;	0%	\$97,000;	100%	\$97,000; 100%
Landrights	\$0;	0%	\$419,000;	100%	\$419,000; 100%
Project Admin.	\$145,000;	78.4%	\$40,000;	21.6%	\$185,000; 100%

Project benefits: Identified project benefits include: reduced damages to structures (mainly homes and businesses), reduced damages to the contents contained within existing structures, reduced damage to public infrastructure (mostly culverts, bridges, stream channels, roadways and associated drainage ditches), reduced disruptions to public use of the roads (especially emergency services) and communication lines, reduced public and private clean-up costs, reduced public administration costs associated with flooding, reduced public and private expenditures to deal with anticipated future flood damages, reduced losses in terms of local business income, and enhanced economic development prospects. Quantified estimates in average annual terms were made for the following principal damage reduction benefit categories:

	<u>Average Annual Equivalents (\$'s) *</u>
Damage Reductions to Structures:	\$295,000
Damage Reductions to Contents:	\$122,000
Reduced Private Clean-up Costs:	\$28,000
Reduced Private Business Losses:	\$116,000
Reduced Public Infrastructure Damages, Clean-up Costs and Repairs:	\$96,000
Reduced Public Administration Costs:	<u>\$27,000</u>
	\$684,000

* February 1998 Price Base. Average annual equivalents based on 7.125% discount rate and a 55 year period of analysis.

Other impacts:

Land use changes: Some residential lots in the City will become vacant and change to miscellaneous lands to get them out of the floodplain, and/or serve as debris basins or channel enlargement areas.

Environmental values changed or lost:

Wooded floodplain: No change
Wetlands: No change
Cultural Resources: No effect

Wildlife Habitat: No change
Fisheries: No change
Prime farmland: No change

Mitigation Issues: If scattered trees along drainageways are destroyed during construction, these areas will be replanted to trees as needed.

Major conclusions: Buena Vista is in need of flood protection from the interior stream drainage. The floodwall constructed by the U.S. Army Corps of Engineers along the Maury River will have no effect on the interior stream flooding problems. The environmental impacts associated with the planned nonstructural and structural measures are minimal. This plan provides an overall approach to addressing the long-standing flood control problems in Buena Vista.

Areas of controversy: Some streets will be closed as the culverts and/or bridges are removed and replaced. This will cause some inconveniences for residents during and after construction.

Issues to be resolved: Much coordination between Federal, State and Local government, private landowners, businesses and industries will be necessary in order to combine available resources and make this long range, comprehensive watershed plan a reality.

A key component of the implementation of this watershed plan will be coordination with the Virginia Department of Transportation (VDOT) for the removal and/or replacement of several bridges and culverts. The successful completion of the Recommended Plan on Indian Gap Run is dependent on some minor changes to the existing VDOT design for the Magnolia Bridge. The changes needed include the installation of larger culverts than are currently planned. The added cost of this improvement is presently not included in this watershed plan and VDOT does not plan to incur additional costs beyond their current design. The added cost of this improvement may need to be borne by someone other than VDOT.

Other: A critical component of this watershed plan is to enlarge the railroad crossings on Indian Gap Run. This is an item that can be funded using PL-566 funds but will require considerable coordination by the City and railroad officials. The railroad officials are willing to cooperate with this project as long as public funds are made available for planning and implementation of the necessary changes.

INTRODUCTION

At the request of the City of Buena Vista and the Natural Bridge Soil and Water Conservation District (SWCD), the USDA, Natural Resources Conservation Service (NRCS) conducted a flood study of the Buena Vista Watershed. This request was prompted by the occurrence of several flooding events, primarily the flood of 1985. Buena Vista and the Natural Bridge SWCD will herein be referred to as the Sponsors.

The Sponsors made a request to the NRCS and the U.S. Army Corps of Engineers for assistance to address their flooding problems. The floods that affected Buena Vista resulted from two distinctly different sources: (1) the Maury River, and (2), the streams that drain from the steep mountains and flow down through the City. The Army Corps developed a flood control plan to address the flooding caused by the Maury River. The NRCS was requested to develop a flood control plan to address the interstream flooding problems.

An Application for Federal Assistance was submitted by the Sponsors to the Virginia Soil and Water Conservation Board in May 1993. The application was given a priority 1 rating and was approved in July 1993. The application was then referred to NRCS for response.

The purpose of this study is to determine the extent of the interstream flooding problem in the Buena Vista Watershed and the potential for reducing this problem.

This study was performed under the authorization provided in the Watershed Protection and Flood Prevention Act of the 83rd Congress (Public Law 83-566, as amended). That legislation authorizes the Secretary of Agriculture to cooperate with other federal, state, and local agencies in the investigation of watersheds and river basins to develop coordinated programs.

PROJECT SETTING

The Buena Vista Watershed is located in Rockbridge County and contains the City of Buena Vista, Virginia. The watershed is comprised of six tributaries to the Maury River. The Maury River flows in a southeasterly direction to its confluence with the James River near Glasgow, Virginia. The USGS 8-digit hydrologic unit number established by the U.S. Water Resources Council is 02080202. The Virginia 3-digit hydrologic unit code is I37.

This watershed includes the tributaries of Long Hollow (1,000 acres), Chalk Mine Run (3,800 acres), Indian Gap Run (1,420 acres), Noel's Run (1,630 acres), Pedlar Gap Run (1,650 acres), and Lowry Run (2,350 acres), for a total of 11,850 acres. Approximately 2,830 acres of these tributaries are located within the City of Buena Vista. The additional 9,020 acres is located in eastern Rockbridge County, mostly within the boundaries of the George Washington and Jefferson National Forests, Pedlar Ranger District. These tributaries flow down the steep western slopes of the Blue Ridge Mountains through the hill and floodplain of Buena Vista before entering the Maury River. The upland areas are in woodland. The floodplain is being used by residences and commercial enterprises with some scattered industries within Buena Vista.

The watershed includes the following mountains, pinnacles or peaks; Lowry Peak, Little Pinnacle, Paxton Peak, Elephant Mountain, Garnet Peak, Silver Peak, Chimney Rock Mountain and McClure Peak. The natural topography of the upland watershed area is very steep and will remain as forest. No significant change in landuse is expected within the watershed.

Topography of the watershed varies widely, with steep slopes in the upper reaches ranging up to and exceeding 50 percent, typical of the East and Central Farming and Forest Region and the foothills of the Blue Ridge Major Land Resource Area (MLRA) 130. The western end of the watershed has topography ranging from gently sloping to moderately steep, typical of the rolling hills of the Southern Appalachian

Ridges and Valleys MLRA 128, with an average slope of 6-12 percent. The floodplains range from narrow to broad along the streams where water that flows out of banks tends to spread out and run erratically due to the manipulation of the floodplain for City streets and residential areas.

The Blue Ridge Parkway and the county line between Rockbridge and Amherst counties, Virginia, form the eastern watershed boundary. The Maury River forms the western watershed boundary. The elevation ranges from 900 feet at the Maury River to 2,500 feet near the Blue Ridge Parkway.

Soils within the watershed vary greatly in depth ranging from Dekalb-Hazleton-Rock Outcrop Complex on a 55-70 percent slope, hydrologic group C, to Alonemill-Clubcaf Complex on 0 to 3 percent slope, hydrologic group B. The upland slopes consist of Dekalb, Hazleton and Oriskany, steep and rocky, which help accelerate the runoff. The flat slopes along the floodplain in the City are predominantly deep, well drained soils of the Alonemill Series. However, these soils are highly urbanized and generally covered with artificial impervious surfaces.

Table A - Landuse in Acres

Forestland	8,900	(8,800 acres in George Washington and Jefferson National Forests)
Pasture/Hayland	100	
Cropland	0	
Urban	2,850	

TOTAL	11,850	

Federally owned land = 8,800 acres

City owned land = 180 acres

Private = 2,870 acres

PROJECT SPONSORS' OBJECTIVES

The sponsors have the following objectives for the Buena Vista Project:

1. Reduce the flood frequency from the City's interior streams;
2. Reduce upstream flood damages to houses, yards, culverts, bridges, gaslines, waterlines, and streets;
3. Catch the debris in structures before it clogs and constricts the City's culverts, bridges, and stream channels, and reduces their capacity to carry flood waters;
4. Reduce the City's maintenance time and cost for culverts, roads, bridges and stream channels;
5. Reduce the risk of hazardous materials spills, such as natural gas and heating oil, that can occur during flooding;
6. Improve the visual quality of the watershed through improved vegetative cover.

WATERSHED PROBLEMS AND OPPORTUNITIES

The major water and related land resource problems that were identified during planning are floodwater damages, unstable and eroding streambanks, debris transport, sediment in channels, and water pollution.

Floodwater Damages

Sudden and intense rainfalls occur frequently along the western slopes of the Blue Ridge Mountains. The extremely steep slopes of this watershed cause the runoff to rush down the mountain streams into the Buena Vista City limits. The floodwaters carry a full bedload of debris which consists of soil, gravel, cobbles, boulders and woody materials. The bedload is moved along the stream channel during

high flows and is quickly deposited as the topography changes suddenly from the steep uplands to the floodplains of the Maury River. The bedload fills stream channels, restricts the flow under bridges, clogs road culverts, and contributes to flooding throughout the watershed.

Following the deposition of the debris, the floodwaters flow out-of-bank and into streets, yards, homes, and businesses. The floodwaters continue to travel downgrade, scouring the floodplains and streambanks until reaching the floodplains of the Maury River. The floodplains become ponded between the railroad tracks and the hillside, causing severe flood damages in this area. The debris that flows on through the City streams becomes deposited as small islands in the main channel of the Maury River.

Floodwater damages occur frequently in the 11,850 acre watershed. The flooding damages occur predominantly in Buena Vista with minor flooding along sections of Long Hollow in Rockbridge County. Flooding problems in the watershed consist of economic losses to streets, bridges, gaslines, waterlines, homes, businesses and industries. Hydrologic and economic studies indicate that a 100-year storm without project protection would flood 246 residences, 71 businesses, 17 public buildings, 5 churches, 2 professional/social buildings and numerous bridges, streets, roads, and utilities resulting in \$9.5 million dollars of urban damages. An additional \$1.9 million dollars in economic losses result from costs associated with infrastructure repairs and the cleanup of the debris left from the floods. These losses are due to the following:

- Debris clogging stream channels and bridge and culvert openings;
- Stream channels, bridges and culverts too small to carry flood flows;
- Operation and maintenance problems due to lack of access to stream for cleanout and culverts and bridges so small that hand labor is required to clean them out;
- Water quality degradation resulting from streambank erosion and hazardous materials spills, such as natural gas and heating oil, that occur during flooding;
- An 8 percent increase in runoff from forestland due to 9 acres of forest fires in 1986 and recent insect damages which killed 870 acres of trees;
- Extensive rock slides in the upland areas which have provided rock and boulder debris for easy transport downstream into Buena Vista.
- Excessive downcutting of the stream channel adjacent to the ball field on Indian Gap which provides sediment and debris materials.

The unpleasant task of clean-up begins after every flood. Sediment and debris block the streams, bridges and culverts and enter homes, businesses and industries. This adversely affects the lives of those who must endure these frequent events. It also has a tremendous impact on the City's Public Works operating budget due to extensive operation and maintenance costs. The Flood of 1985 clean-up and repair costs were approximately \$1,064,000, not including Emergency Watershed Protection Program expenditures. Following the flood of 1995, over \$376,000 was spent by the NRCS on stream clean-up and channel stabilization through the Emergency Watershed Protection Program.

A forest fire in 1986 resulted in a loss of approximately 9 acres in the watershed. Since the area is extremely steep and rough, the U.S. Forest Service manages the area under the "Remote Highlands" classification in order to provide older vegetation where recreationists can obtain a degree of solitude and where the environment can be maintained in a near-natural state. Only light on-the-land management activities occur. The Forest Service does not plan to replant the burned area. The area is revegetating naturally. Meanwhile, there is a slight increase in runoff.

The watershed also experienced an infestation of forest insects in the last few years. The Southern Pine Bark beetle has infested approximately 870 acres of forest in this watershed. This has resulted in less vegetation and subsequent water uptake. The runoff has increased approximately 8 percent as a result. Table B displays the watershed analysis of the additional runoff.

Table B - Subwatershed Water Yields (acre-feet)

<u>Subwatershed</u>	<u>Baseline Water Yield</u>	<u>Maximum Water Yield</u>	<u>Percent Increase</u>
Indian Gap Run	1,000	1,120	12
Chalk Mine Run	1,817	2,007	10
Pedlar Run	1,198	1,258	5
Poplar Cove Run	1,327	1,363	3
Noel's Run	1,658	1,725	4
South Fork	1,047	1,132	8
Washer Hollow	1,267	1,443	14
Wilmouth Hollow	1,278	1,339	5
	-----	-----	--
	10,592	11,387	8

The gypsy moth is expected to reach this area during the next five years. This will cause additional tree mortality and result in added runoff.

An 8 percent increase in runoff (annual water yield) does not necessarily translate into a comparable increase in peak flows or storm flows. Most of the increase in water yield will be summer base flow, since that is when there will be the most difference in evapotranspiration resulting from the loss of live trees. Research has shown some increase in storm flows for smaller storms after timber harvests, but little increase for the major flood-producing storms. In the larger storms, the soils are already saturated, so there is little difference between a harvested and an unharvested watershed. However, there could be small incremental increases in storm flows resulting from the fire damage and insect infestation.

Based on aerial observations, there are approximately 11.2 acres of boulder fields in the watershed, of which 5.1 acres occurs in the Indian Gap Run subwatershed. These boulder fields, the down cutting of the stream channel near the ball field and the cobbled stream banks provide a ready supply of debris material to the streams. These materials move downstream, clog culverts, and create stream blockages at most road crossings during storm events.

In addition to the obvious floodwater damage and losses, there is the toll of mental anguish from the loss of possessions and fear of impending flooding from every rain. In the City, there is also the threat of businesses who close down and never reopen following these frequent floods. Businesses become discouraged and move away, or never locate in the area, taking away valuable jobs. In a City with limited resources and a declining job market, financial recovery is more difficult following each flood.

Sediment Transport and Damages

The deposition of the bedload sediment and debris reduces the stream channel capacity and fills in culverts and bridges. The floodwaters then flow out of banks. The floodwaters travel downgrade, cutting into the cobble streambanks and scouring the floodplains. Using this process repeatedly, the floodwaters pick up additional bedload and suspended sediment. Part of the suspended sediment is deposited in buildings, on highways, on streets and on sidewalks. The rest is transported downstream into the Maury and James Rivers.

The upper reaches of Noel's Run and Pedlar Gap Run support native trout and the streams are perennial. In the lower sections of the stream, the deposited sediment bedload creates a porous channel bottom in which the stream flow moves under and through the sediment material, causing the perennial streams to become intermittent.

Scouring of stream channel on Pedlar Gap Run after April 1992 flooding.



Indian Gap Run after April 1992 flood.
Reeves Brothers Plant in background.

Destruction of street and blockage of street culvert with debris and sediment on Pedlar Gap Run from April 1992 flood.



Debris and sediment blocking street culvert near confluence of Noels and Indian Gap Runs after April 1992 flooding.



Destruction of 12th Street from Noels Run in April 1992.

Destruction of culvert on Hawthorne Avenue from April 1992 flood.



Sediment and debris blocking street culvert on Noels Run after April 1992 flooding.



Destruction of Hawthorne Avenue from Noels Run during the April 1992 flood.

Debris deposited along Chalk Mine Run during the April 1992 flood.



Unstable and Eroding Streambanks

The eroding streambanks encroach on and threaten the adjacent properties. The damages include lost yards, landscaping, buildings, driveways, homes and businesses. The private landowners are left with either scoured out holes in their properties or huge piles of cobbles and debris. The scoured out banks provide additional bedload to the floodwaters which ultimately is deposited elsewhere causing further damages downstream.

Water Quality

Soil particles are scoured from the streambanks and floodplains, go into suspension, and are transported into streams and rivers, thereby, degrading downstream water quality. The floodwaters pass through urban and residential areas which contain oils, greases, fertilizers, gas, chemicals and other contaminants. These contaminants are picked up and transported into receiving waters. This process adds to the degradation of the water quality in the watershed and downstream.

SCOPE OF THE BUENA VISTA WATERSHED PLAN

The need for treatment of the Buena Vista Watershed was first recognized and promoted by the Sponsors following the 1985 flood. The sponsors contacted both the U.S. Army Corps of Engineers and the NRCS after 1985. The Corps took the lead and developed a flood control plan for the control of the Maury River. The Corps has constructed a flood wall which will protect most of the City from Maury River flooding. The flood wall starts downstream of the confluence of the Maury River and Chalk Mine Run and extends to a point downstream of the original confluence of the Maury River and Pedlar Gap Run. Chalk Mine Run flows into the Maury River unobstructed by the flood wall. Noel's Run joins with Indian Gap Run before they get to the flood wall. Indian Gap Run then passes through the flood wall via culverts with flap gates. If the Maury River stage is too high, an alternate route is provided through an interior drainage canal. Pedlar Gap Run is diverted through a lower portion of the flood wall by an interior drainage canal via culverts with flap gates and then drains into the Maury River.

Early in the development stages of the Corps flood wall project, it was unclear which agency would address the interior streams flooding problem. The NRCS effort was begun by the joint NC/VA Water Resources Planning Staff headquartered in Raleigh, NC. The project was turned over to the Virginia NRCS Planning Team in October 1991. In November 1991, the NRCS Planning Team, accompanied by the planning specialists from the Northeast National Technical Center in Chester, Pennsylvania, conducted a field reconnaissance of the watershed. Coordination among agencies to scope issues to be addressed during planning was initiated during this general time period.

In May 1993, following the flood of 1992, the Sponsors submitted an Application For Federal Assistance requesting that NRCS address the interior streams flooding problem.

A meeting was held in Buena Vista on September 15, 1993 to discuss future planning strategies. A follow-up field visit was conducted in October 1994.

In June 1994, a public meeting was held at the Buena Vista City Hall. The meeting was attended by approximately 30 people who were landowners and/or government agency representatives. The project was discussed with people voicing their issues and concerns about the watershed. Almost all in attendance were supportive of the project and were in favor of pursuing the development of a flood control plan for the Buena Vista Watershed.

The project was discussed at a scoping meeting held on February 28, 1995. The meeting was attended by NRCS, U.S. Forest Service, Virginia Department of Conservation and Recreation, City of Buena Vista, Army Corps of Engineers, Central Shenandoah Planning District Commission and local

landowners. Forty other groups and individuals that were on a U.S. Forest Service scoping list were also contacted by letter.

A second scoping meeting was held on September 3, 1998 in Lexington following the decision to prepare an EIS on the watershed. Due to a lack of interest and the feeling that the watershed had already been adequately assessed and the impacts properly evaluated, the only attendance at the meeting was by NRCS employees responsible for planning the watershed.

The following table is a summary of the concerns identified through the scoping process listed above. The issue that was most often discussed and of highest significance was flooding.

Table C - Evaluation of Identified Concerns

<u>Economic, Social, Cultural, and Environmental Concerns</u>	<u>Degree of Concern 1/</u>	<u>Degree of Significance to Decision Making 2/</u>
Human Health and Safety	High	High
Flooding	High	High
Sheet, rill, ephemeral and gully erosion	Medium	Medium
Sedimentation	Low	High
Streambank Erosion	High	High
Socio-Economic	Medium	Medium
Water Quality	Medium	Low
Recreation	Low	Low
Fish and Wildlife Habitat	Medium	Medium-High
Land Use Conversion	Low	Low
Endan., Threat., and Rare species	High	High
Prime and Important Farmland	Low	Low
Visual Resources	Medium	High
Wetlands	High	High
Cultural Resources	High	High
Air Quality	High	Low

1/ High degree of concern - may not be significant to decisions.

2/ Three levels of significance are used:

- a. High - Must be considered in analysis of alternatives if significant to decision.
- b. Medium - May be affected by some alternative solutions.
- c. Low - Need not be considered in the analysis.

In August 1995, following the severe flooding in June 1995, NRCS met with FEMA and the Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation, Floodplain Management Section, to discuss the need to have the hydrology and hydraulics models run for the Buena Vista Watershed interior streams. This led to a contract being awarded to Woodward Clyde Federal Services, who subcontracted to Dewberry and Davis, for the modeling work. Several meetings occurred between NRCS, Dewberry and Davis, and the local sponsors. A public meeting was held on October 24, 1996, at City Hall where the watershed model results were presented and accepted by those in attendance.

INVENTORY OF EXISTING RESOURCES

Socioeconomic Resources

Population

Buena Vista experienced its greatest population growth in the 1940s and 1950s. This population growth was attributed primarily to increased industrial activity. This increase is reflected in the housing stock of the City, of which 56% was built before 1960. Prior to this growth period, Buena Vista initially grew as an industrial city as part of the Shenandoah land "boom" in the 1890s. The population of Buena Vista reached 1,044 in 1890, then more than doubled to 2,388 by 1900. This "boom" was initiated by several land development companies, one of which was the Buena Vista Company. In less than three years, Buena Vista grew from a sparsely populated rural area to a town with 19 industries, employing in excess of 1,000 workers.

The Population of Buena Vista was 6,406 in 1990 (1992 U.S. Census, U.S. Dept. of Commerce). This represents a 7.2% loss in population from 1980. The population is expected to decrease by another 7% by the year 2010 (Virginia Employment Commission 1993). Minorities comprise approximately 4.9% of the population, with 4.4% being African-American.

The age distribution of the City residents, which indicates potential for economic growth through demand for goods and services, is somewhat older than the state as a whole, reflecting the decline in population and out-migration of young people. The percentage of Buena Vista residents over the age of 65 is 16% compared to 11% for Virginia. The median age for Buena Vista residents is 36.4, compared to 32.7 for Virginia.

Employment

The number of employed persons in the City was approximately 2,095 working at 131 establishments. Manufacturing is the largest employment sector in the City. The retail and educational services sector provide a majority of the remaining employment. Although manufacturing is the most important sector of Buena Vista's economy, actual manufacturing employment has declined since 1970. Some of this decline may be due to an overall trend in the manufacturing industry toward automation and consolidation of existing plants. However, the 1985 flood was a major factor in the closing of two factories (Rea Magnet Wire and Reeves Brothers) and is most likely a deterrent to expansion by existing plants or the location of new factories to Buena Vista.

Periodically, unemployment has been a problem in Buena Vista. For example, in 1975, the rate exceeded 15%, compared to a national rate of between 8% and 10%. More recently, the rate has fluctuated between 7.5% (1990 annual average) and 11.5% (July 1993). Unemployment rates in Buena Vista are affected much more by fluctuations in regional and national demands for manufactured goods than the rates for the state and the nation as a whole. The following table shows unemployment rates of Buena Vista compared to that of Virginia and the entire country:

Table D - Unemployment Rates in Buena Vista

	1992	1993	1994
Buena Vista	10.3%	10.9%	6.2%
Virginia	6.4%	5.0%	4.9%
U.S.	7.4%	6.8%	6.1%

Source: U.S. Census Bureau and the U.S. Department of Labor Statistics

By 1994, unemployment in Buena Vista was down to 6.2% from 10.9% in 1993, while the state-wide average rate of unemployment was at 4.9%. In 1993, there were 1,545 Social Security beneficiaries in

Buena Vista, 885 retired workers, 320 survivors of retirees and 175 individuals receiving disability income. Of the remaining workforce, 48% of Buena Vista's working residents were employed outside of their locality of residence.

Education

Like many communities where manufacturing is the dominant employer, educational attainment levels are lower than that of the Commonwealth and nation. In Buena Vista, 40% of the residents over the age of 18 have not graduated from high school, compared to 20% of the residents of Virginia, and 17% of the U.S. as a whole. (Figure does not reflect number of persons who received their GED). However, the school department has an active program of recruiting people back to obtain their GED and the dropout rate has been lower than Virginia's over the last twenty years. The Buena Vista High School is Virginia's only nationally recognized year-round high school program. The City supports an elementary school and a small two-year college, The Southern Virginia College. In addition, the City of Lexington is home to two schools of higher education, the Virginia Military Institute and Washington and Lee University. These schools and their economic spin-off effects provide jobs for some of Buena Vista's residents.

Income

The Buena Vista Storm Drainage/Flood Control Survey was part of a survey conducted to identify the income status of persons in the floodplain who were adversely affected by the April 1992 flooding. The survey found that 337 persons (178 households), or 66.2% of those interviewed, had incomes below the low-to-moderate income limits as defined by the latest HUD Section 8 income guidelines for the City. Average household income for Buena Vista residents in 1989 was \$26,827, while per capita income (PCI) was only \$10,241. PCI for the U.S. during the same year was \$17,596, making Buena Vista's PCI only 58% of the national per capita income level. However, the per capita income for Buena Vista had improved to 72% of the Virginia average and 74% of the national average by 1995 (\$17,410, \$24,282 and \$23,359 respectively). Median household income for Virginia in 1995 was \$40,203, while Buena Vista's was \$29,994 (74% of the statewide median). Fourteen percent (870) of Buena Vista's total population lived below the poverty level in 1989, as compared to ten percent for all of Virginia. By 1993 this figure had not changed for Buena Vista as 14 percent (876) of the resident population of Buena Vista still lived below the poverty level. Over 21 percent of all Buena Vista residents under 17 lived below the poverty level in 1993. With respect to household data, over 15 percent of Buena Vista's households (371) were considered to have residents living below the poverty level in 1989, as compared to 10.5 percent for the state as a whole.

Housing

Housing in Buena Vista is made up of predominantly single-family, owner occupied units. Almost 89% percent of all existing structures in Buena Vista were built before 1980. Fifty-six percent were built before 1960, and 22% were built before 1940. A high percentage of rented houses exist in the floodplain area, however. The City is populated with a variety of dwellings. Many of the higher valued dwellings are located at higher elevations. Houses in the floodplain are primarily small to medium sized frame dwellings. The median house value in the City in 1990 was \$43,300, while the median value of a house in Virginia was \$91,000. Therefore, houses in Buena Vista are only 48% of the median house value in Virginia.

As of 1993, 130 National Flood Insurance policies were in effect in Buena Vista. Total premiums paid amounted to \$63,390 providing coverage of \$12,778,000. Total claims paid out since 1978 were \$2,980,000 (FEMA data, July 1993).

Transportation

Proximity to major transportation routes is an important determinant of economic development in an area. Buena Vista is located four miles from Interstate 81 and a short distance from the junction of Interstate 81 and Interstate 64. Two state highways run through the City as well as an operating railroad. Route 60 and Route 501, which run through the City, are considered by the State of Virginia to have potential for Scenic Byway status.

Recreation

On the western side of the Maury River is the City's major recreational area, Glen Maury Park, encompassing 315 acres. Recreation occurs along the Maury River primarily in the form of boating, fishing and hiking. The floodplain also contains small neighborhood parks which have sustained limited damage in past floods. There are several trails along the hollows of the interstream tributaries that connect hikers and hunters to both the Blue Ridge Parkway and the Appalachian Trail.

Fishing utilization in the watershed is confined primarily to the Maury River and to two trout streams which are located in the headwaters of Noel's Run and Pedlar Gap Run. The sections of these two streams where the trout are located, are on U.S. Forest Service land which is upstream of the proposed project for Buena Vista. Recreation use of the four wild trout streams in the area is considered low to moderate by VDGIF. Little to no fishery use is made of the other tributary streams except for occasional use by children.

Hunting use within the George Washington and Jefferson National Forests and adjacent privately owned woodland is moderate for big game species and low to moderate for small game, principally squirrel. Some limited trapping occurs, especially along streams within the watershed.

Soils

Soils within the watershed vary greatly in depth ranging from Dekalb-Hazleton-Rock Outcrop Complex on a 55-70 percent slope, hydrologic group C, to Alonemill-Clubcaf Complex on 0 to 3 percent slope, hydrologic group B. The upland slopes consist of Dekalb, Hazleton and Oriskany, steep and rocky, which help accelerate the runoff. The flat slopes along the floodplain in the City are predominantly deep, well drained soils of the Alonemill Series. However, most of these soils are located in the urbanized area of the watershed and are covered either with asphalt, concrete or roof.

Geology

The proposed project location is located on the eastern edge of the Valley and Ridge physiographic province with the upper portion of the watershed located in the Blue Ridge. Bedrock in the area is predominantly the Chilhowee Group, composed of the Antietam Formation, a medium to very thick-bedded, very resistant quartzite; Harpers formation, a dark colored, fine-grained, very resistant quartzitic sandstone; and the Weaverton Formation, an interbedded quartzite, metasandstone and phyllite, all of which are moderately to very resistant. It is this material, along with granite and granitic-gneiss from the Blue Ridge that is transported in volume downslope during major storm events, that cause the debris blockage on the stream channels in the City and the resultant flooding.

A literature survey was conducted on the proposed project area southeast of Buena Vista. The Corps of Engineers and the Buena Vista City Engineer were also contacted as to location and content of already identified suitable borrow areas. These borrow areas were used by the Corps for the construction of the Maury River flood wall.

Indian Gap Run, Pedlar Gap Run, Noel's Run, and Chalk Mine Run are located approximately 1 to 2.5 miles from the fine grained borrow area at Cedar Ridge. Bedrock at the Cedar Ridge borrow site appears to be at the Waynesboro Formation, a predominantly gray dolomite and limestone interbedded with mudstone and grayish-red sandstone. Buena Vista owns the land, there appears ample reserves, and the material grades from a (CL) sandy clay to a (SC) clayey sand with gravel. There are also sources of riprap in the general area located at Glasgow, Lynchburg, Piney River, Blue Ridge, Lexington, and Staunton.

Climate

The climate in Buena Vista is moderate with an average annual temperature of 54 degrees F and average annual precipitation of 38 inches. The highest average monthly precipitation occurs in July, October and May, respectively.

Buena Vista is susceptible to extreme precipitation events due to its geographic location within the valley. Buena Vista is most susceptible during hurricane season from hurricanes and tropical storms moving from the Gulf of Mexico northward across the United States and up through the Shenandoah Valley. The result can be heavy flooding of the Maury River. The floods of 1969 and 1985 are the most severe floods in Buena Vista's history that resulted from tropical storm remnants.

Buena Vista is also susceptible to quick peaking floods from the tributaries that flow through the City. These quick peaking floods occur when a storm front slows as it moves across the Blue Ridge Mountains and releases rainfall onto the shallow soiled, steep watershed terrain. Flooding is most likely to occur when the antecedent moisture condition is high from long duration precipitation followed by a short duration, high intensity storm. This was the case for the April 1992 flood that caused severe flooding on these tributaries flowing through Buena Vista.

Climatic summary data for Buena Vista is provided in the following table. This table includes temperature and precipitation averages and probabilities based upon 47 years of record (1948-1995).

Table E - Climatic Data

Month	Temperature (Degrees F.)						Precipitation (Inches)				
	avg daily max	avg daily min	avg	2 yrs in 10 will have		avg # of grow deg days*	avg	2 yrs in 10 will have		avg # of days w/.1 or more	avg total snow fall
				max temp. >than	min temp. <than			less than	more than		
January	39.3	16.6	28.0	65	-18	12	2.65	1.08	3.98	5	5.0
February	49.4	22.3	35.8	79	6	86	2.85	1.40	4.11	5	3.7
March	60.7	31.7	46.2	83	12	246	3.37	1.71	4.82	6	2.0
April	72.6	39.9	56.2	93	22	478	3.09	1.51	4.46	6	0.1
May	77.8	46.5	62.1	93	30	640	3.39	2.22	4.45	7	0.0
June	82.1	54.5	68.3	94	34	779	3.19	1.56	4.60	5	0.0
July	89.7	60.1	74.9	101	43	956	3.82	2.25	5.22	7	0.0
August	88.2	57.1	72.6	99	39	996	3.13	1.42	4.60	5	0.0
September	83.6	54.5	69.0	97	35	804	2.87	1.13	4.33	5	0.0
October	64.5	41.6	53.0	80	21	404	3.54	1.34	5.38	5	0.1
November	56.3	31.4	43.9	76	2	163	3.05	1.54	4.36	5	0.4
December	47.7	22.0	34.8	68	8	37	3.13	1.54	4.51	5	1.8
Yearly :											
Average	67.7	39.9	53.8	---	---	---	---	---	---	---	---
Extreme	102	-18	---	103	-9	---	---	---	---	---	---
Total	---	---	---	---	---	5600	38.08	27.90	40.62	66	13.1

Average # of days per year with at least 1 inch of snow on the ground: 6

Hydrography

The watersheds for the interior streams are primarily steep, shallow-soil, forestland with a considerable number of rock outcrops. The streams begin in the ravines of the Blue Ridge Mountains that are adjacent to the City. They begin as steep, rock-bottomed rapids that gradually taper off in slope as they approach the foothills of the mountains. The stream channels gradually increase in size and rock debris content as the slope decreases over distance. The slope flattens significantly as each channel reaches the floodplain of the Maury River, located within the City limits of Buena Vista. The rock debris carried out of the steep mountainous watersheds are deposited as a result of the water velocity decreasing with slope decline. The rock is deposited along the stream banks and areas of constriction such as bridges and culverts. It is this rounded rock debris that clogs the bridge openings and culverts during heavy flows. As these blockages form, water can no longer flow within the natural stream banks. The storm water flows out of bank and across the residential and commercial properties within the City. This sheet flow takes the path of least resistance and eventually makes its way back into the channel at some lower elevation. The out-of-bank flow is the primary cause of flood damages within the upper parts of the City's residential area.

Pedlar Gap Run, Noel's Run, and Indian Gap Run were surveyed to determine their hydrogeomorphic characteristics. These streams are relatively confined, with narrow floodplains and low sinuosity. Stream bottoms are predominately cobble, but boulders and bedrock are common in some reaches. Channel gradients in the narrow gaps are relatively steep (3 to 5 percent). These watersheds are dominated by the Antietam formation composed of quartzose sandstone, which forms the series of peaks on the edge of the City. On the steep side slopes where the streams cut through this formation, boulder fields are common, providing a ready source of rock material to the streams. Smaller streambed material shows evidence of frequent movement. This rock debris has formed a broad outwash plain where the streams leave the mountains, lose their steep gradient, and drop the debris. Much of Buena Vista is built on this outwash plain. It is the natural tendency of the stream channels to move back and forth across the plain.

Short reaches were surveyed for large woody debris in or along the channel. On Indian Gap Run, there are approximately 189 pieces per mile; on Noel's Run, 117 pieces per mile. The pieces measured were at least 4 inches in diameter and 5 feet long. The desired future condition, according to the George Washington and Jefferson National Forests Management Plan, is 125-300 pieces per mile on cold water streams. This optimum level provides good aquatic habitat from one perspective. On the other hand, this amount provides a debris source and could be contributing to stream blockages during storm events.

Flooding

Floods from the Maury River and streams which flow down from the Blue Ridge mountains and through the City cause widespread damage and destruction over large areas affecting many Buena Vista residents. The flood wall constructed by the Army Corps of Engineers will deal directly with the Maury River flooding and should significantly reduce future damages in Buena Vista associated with the Maury. Flooding from the intercity streams will continue to occur. One of the major reasons that flood waters pond at the lower end of each stream is that the slope of the stream flattens out when the channel reaches the floodplain of the Maury River. This flatter grade causes the water to slow down and spread out over a greater area. Several locally led efforts to re-size culverts, remove obstructions, expand channel capacities, and relocate houses that experience repetitive flood losses, are underway. These efforts will diminish future damages from the intercity streams, but will not eliminate them.

Contingency planning can reduce future damages and alleviate suffering and hardship. This planning involves the cooperation and coordination of Federal, State and local governments along with private citizens. Activities include enacting land-use restrictions in flood-prone areas, issuing severe weather warnings, floodproofing, and constructing flood mitigation structures.

Floodplain Management

The State of Virginia has established floodplain zoning as the floodplain management technique to control use of land in flood-prone areas. The responsibility and authority for zoning are the function of local governments. The Virginia Flood Reduction Act was enacted to guide the development of floodplains. The Act provides State coordination and assistance in floodplain management by encouraging local governments to adopt, administer, and enforce floodplain management ordinances; by providing the authority necessary to conduct a floodplain management program; and by coordinating Federal, State and local floodplain management activities. After compliance, areas subject to recurrent flooding can qualify for protection in the National Flood Insurance Program. Thus, citizens living in these areas can insure themselves against flood losses through the purchase of flood insurance.

Both Buena Vista and Rockbridge County participate in the National Flood Insurance Program. Buena Vista entered the National Flood Insurance Program on August 1, 1978. Rockbridge County entered on January 3, 1979.

Flood Warning Systems

The dissemination of warnings of potential flooding in the Commonwealth is the responsibility of the Virginia Department of Emergency Services. They inform local governments of flood information passed to them from the National Weather Service. Local governments are warned of predicted floods and, in turn, issue official warnings to the general public in the areas affected. The flash flood warning system, the Integrated Flood Observing and Warning System (IFLOWS), is a cooperative system developed and operated by the National Weather Service and the Virginia Department of Emergency Services. The system consists of computer software and hardware designed to assist in the management of flash floods caused by localized, intense rainfall. Buena Vista and Rockbridge County both utilize IFLOWS to warn their residents of impending flooding and the anticipated extent of the floodwaters on the Maury River.

Due to the small size and very quick response times of the Buena Vista subwatersheds, there are no warnings for the interior streams. All of the IFLOWS monitoring stations in Rockbridge County are located on Maury River, South River and Irish Creek, which have much larger drainage areas.

Wetlands

Review of the Department of Interior's National Wetland Inventory and the NRCS's Wetland Inventory and field evaluations indicated no wetlands along any of the principal tributary streams evaluated for possible action. The only wetlands of any type known to occur in the Buena Vista Watershed are 3 or 4 small man made ponds classified as PUBHh, Palustrine unconsolidated bottom permanently flooded, in USDI "Classification of Wetlands and Deepwater Habitats of the United States".

Cultural Resources

Review of the Virginia Department of Historic Resources' (DHR) records of known archaeological and historical sites and discussion with representatives of the State Historic Preservation Officer (SHPO) revealed the following sites in the Buena Vista Watershed:

Table F - Historic Sites on the National Register

<u>Site No.</u>	<u>Description of the Site</u>
178	Lock #6 of the North River (Kanawha) Canal adjacent to the Maury River
233	Toll House at lock #5 (canal)
234	Indian Gap Run Aqueduct (confluence of Indian Gap Run and canal)
235	Lock # 3 (canal)
236	Chalk Mine Run Aqueduct (confluence of Chalk Mine Run & canal)
336	Canal between Maury River and C&O RR (immediately upstream of Long Hollow Road)

Three standing structures in Buena Vista, including buildings on the campus of the Southern Virginia College, at Glen Maury and the old courthouse, are also listed on the National Register.

Three archaeological sites (including prehistoric, archaic and historic Indian camps) were found near the confluence of South Fork and Washer Hollow streams during previous reconnaissance surveys for development of an industrial park. In addition, an area about 50 acres in size containing a late 19th/early 20th century iron ore mining site was also discovered during that survey. Much of these areas were impacted or lost during construction of the park.

Two other archaic period Indian campsites have been identified on the Maury River floodplain between the confluence of Pedlar Gap Run and Lowry Run.

During the field evaluation of the principal tributary streams, old concrete dam/chute structures were found on U.S. Forest Service land in the upstream portions of Indian Gap Run and Noel's Run. These structures may have been built during the Civilian Conservation Corps (CCC) era.

In formal comments provided by DHR, they stated that no further identification efforts are needed for archeological properties. However, historic structures (four railroad bridges and one small road bridge) will be surveyed and consultation with the State Historic Preservation Officer will be conducted prior to construction. No formal archaeological survey will be required within the construction limits of the proposed project.

Threatened, Endangered and Rare Species

The U.S. Fish and Wildlife Service, the Virginia Department of Game and Inland Fisheries, the Virginia Department of Agriculture and Consumer Services, and the Virginia Division of Natural Heritage (DNH) were consulted to determine if any listed or proposed threatened or endangered (T&E) species are known to occur in the watershed. Results of the inquiry indicated that no T&E species are present.

DNH indicated that other 'non listed' (not legally protected under the Endangered Species Act but considered significant by DNH) Natural Heritage Resources do occur in the watershed including the following:

Geologic Features:

- A 'significant cave'

Invertebrates:

- Price's Cave Isopod, *Caecidotea pricei* (State special concern)
- Yellow Lance, *Elliptio lanceolata* (State special concern & Fed. candidate category 2)
- A Pusio Group, *Pseudanophthalmus* sp. 11 (Extremely rare state & globally)
- Rockbridge County cave planarian, *Sphalloplana virginiana* (Extremely rare state & globally, federal candidate category 2)
- Rockbridge County Cave Amphipod, *Stygobromus barodyi*, (State special concern)

Plants:

- Tall Larkspur, *Delphinium exaltatum* (Fed. candidate category 2)
- Slender Spikerush, *Eleocharis elliptica* (State very to extremely rare)
- Three-Flowered Melic Grass, *Melica nitens* (State extremely rare)
- Canby's Mountain-Lover, *Paxistima canbyi* (State candidate & Fed. candidate category 2)
- Lance-Leaved Buckthorn, *Rhamnus lanceolata* (State very rare)
- Wild Black Currant, *Ribes americanum* (Historically known from the state)
- Northern Prickly-Ash, *Zanthoxylum americanum* (State rare to very rare)

Consultation with DNH and onsite review indicated that none of these natural resources are present within the limits of any proposed construction areas.

Scenic Rivers

No streams within the limits of the watershed have been designated state scenic rivers or listed by the National Park Service's Nationwide Rivers Inventory as meeting minimum criteria for further study and/or potential inclusion into the National Wild and Scenic Rivers System.

Aquatic Resources

The Buena Vista Watershed contains six major tributary streams feeding the Maury River and the portion of the Maury River flowing through Buena Vista. The Virginia Department of Game and Inland Fisheries (VDGIF) classifies portions of two tributary streams (Noel's Run and Pedlar Gap Run) as wild brook trout streams based on their sampling. The other tributary streams in the watershed have been classified as mixtures of warm water/intermittent flow streams. Associated fish species in all these tributary streams include Torrent sucker, *Moxostoma rhothoecum*; Bluehead chub, *Nocomis leptocephalus*; Mottled sculpin, *Cottus bairdi*; and various dace species including the Blacknose dace, *Rhinichthys atratulus*, according to VDGIF. No sport fish species, except trout as noted below, are known to occur in any of the tributaries, except immediately adjacent to the Maury River. The Maury is a

typical mountain/valley smallmouth bass stream. Streams present, their lengths and VDGIF classifications are shown below.

Table G - Stream Classifications of the Buena Vista Watershed

	<u>Length (Ft)</u>	<u>Intermittent (I)</u> <u>Perennial (P)</u>	<u>Warm (W)</u> <u>Cold (C)</u>	<u>Trout</u> <u>Stream</u>
Maury River	13,000	P	W	No
Long Hollow	5,400	P	W	No
	6,000	I	W	No
Chalk Mine Run	20,400	P	W	No
	20,000	I	W	No
South Fork	7,200	P	W	No
Trib. of Chalk Mine	3,000	I	W	No
Indian Gap Run	11,000	P	W	No
	3,600	I	W	No
Noel's Run	9,600	P	C	9,000'
	11,000	I	C/W	No
Pedlar Gap Run	18,000	P	C/W	13,300'

VDGIF classifies Noel's Run as a class II wild trout stream and Pedlar Gap Run as a class III wild trout stream. Pedlar Gap Run, where sampled by VDGIF, averages from 4 to 12 feet wide while Noel's Run ranges from 7-12' wide. These streams are high gradient, averaging from 320-380 feet of fall per mile. Shading averages from 80-100% throughout the trout and mountainous stream sections of the watershed. The sections of Noel's Run and Pedlar Gap Run where the trout are located are on U.S. Forest Service land, which is upstream of the proposed project for Buena Vista. Lack of shading and other urban impacts limits habitat for fish and other aquatic species in the downstream sections of all the tributaries.

Wildlife

Within the City limits of Buena Vista, wildlife habitat and biodiversity is limited to species commonly adapted to urban conditions. Biodiversity is high in the largely wooded areas of the watershed. This high diversity is due mostly to isolation caused by steep terrain and the high percentage of public ownership within the watershed. Most of this area is covered with hardwood forest and scattered clumps of pine trees. Large expanses of boulder fields are common along the steep stream bluffs.

Large animal species including black bear, wild turkey, deer and bobcat are common throughout the wooded portions of the watershed. Small animals including gray squirrel, raccoon, opossum, gray fox, various amphibians, and reptiles also occur in the watershed. Rabbits, quail, and other openland game species are rare due to the lack of non-urban herbaceous cover. Neotropical migrants as well as other birds common to mountainous areas of Virginia occur in the area. Forest habitat fragmentation is limited primarily to boulder fields within the extensive, relatively unbroken, hardwood tree cover of the George Washington and Jefferson National Forests. Riparian woody vegetation, although incomplete and scattered, does provide limited habitat for wildlife within the City limits.

Water Quality

Even though there are no water quality monitoring stations in the watershed, the water quality is considered to be good. Flooding degrades water quality due to additional sediment loading, sewer overflows and broken sewer and gas pipes. Floodwaters wash oils and gas from parking lots, streets and driveways into the streams. This causes a reduction in water quality in the watershed and downstream.

Forestry Resources

Forested land in the watershed is predominately in the George Washington and Jefferson National Forests under U.S. Forest Service ownership. Much of the timber is of low quality on steep inaccessible land.

On Forest Service land in these watersheds, 34% of the timber is classified as chestnut oak and scarlet oak, 14% is yellow (pitch and table mountain) pine, 30% is mixed yellow pine and oak, 13% is white oak/northern red oak/hickory, and 9% is yellow poplar/white oak/northern red oak. Refer to the figure on the next page for a display of timber types.

Only 4% of the timber on Forest Service land is classified as mature sawtimber and another 25% is mature poletimber. Eighteen percent is immature sawtimber and 2% is immature poletimber. Thirty-eight percent is classified as low quality. Refer to the figure on the next page for a chart on the timber stand class condition.

Seventy-two percent of the timber is 70 to 100 years old. Only one percent has been harvested in the past twenty years, and another 10% was harvested 20 to 30 years ago.

The National Forest Management Plan allocates most of this area (80%) to Management Area 9 (remote highlands) and Management Area 7 (scenic corridors along U.S. 60 and the Blue Ridge Parkway). Both of these management areas are designated as unsuitable for timber management.

Twenty percent of the area is in Management Area 14 (remote habitat for wildlife). This area, which is limited to the upper portions of the Pedlar Gap Run, Lowry Run, and Poplar Cove Run watersheds, is managed to maintain or enhance habitat for wildlife species that favor a mature forest environment, areas of dense vegetation cover, and freedom from continued disturbance. Within this area, 86% (1,221 acres) is designated as suitable for timber management. Timber in most of this area is better quality hardwoods. However, one-third of the Poplar Cove Run watershed is in young stands due to salvage harvests in the mid 1960's following the Hellgate Fire. Timber in Management Area 14 is harvested on long rotations. Harvest areas average about 20 acres, with a maximum size of 25 acres.

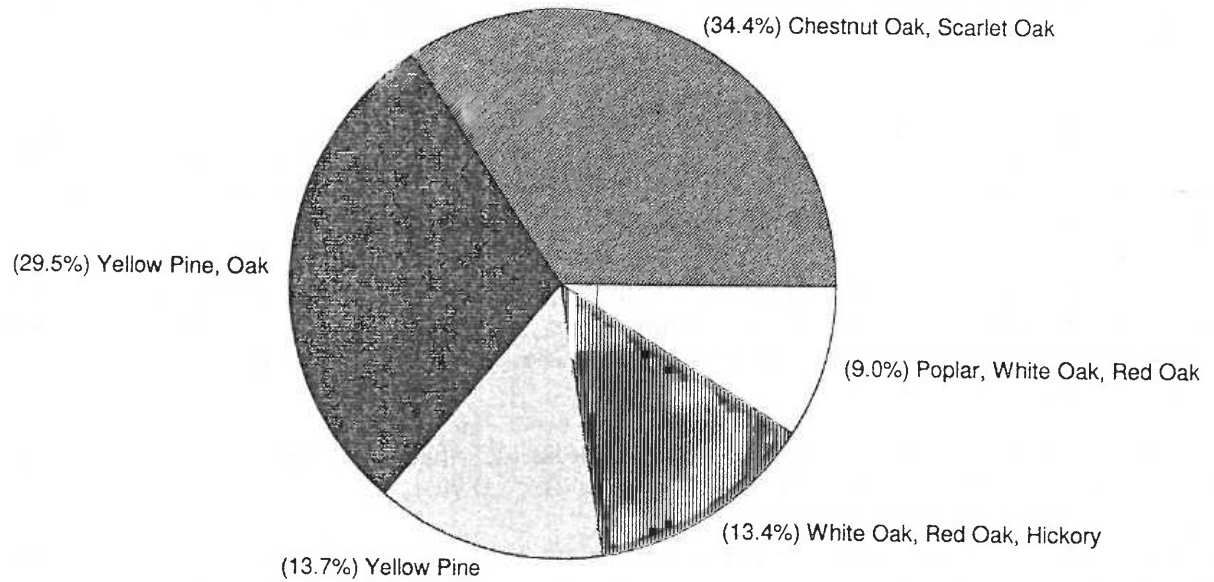


Figure 1. Timber Types

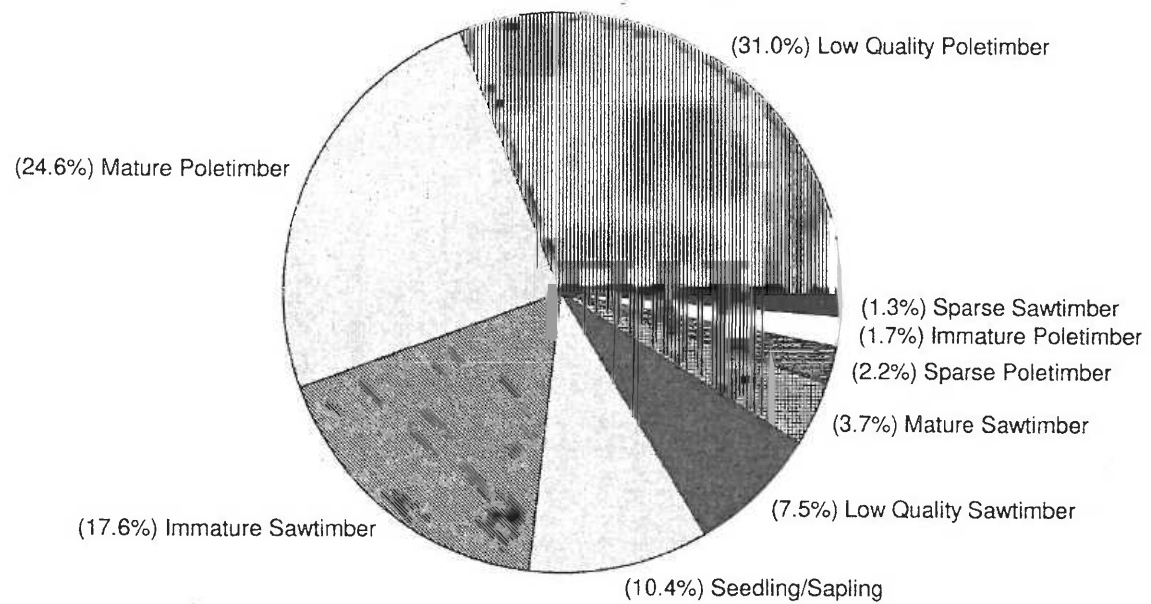


Figure 2. Timber Stand Condition Class

ANALYSIS OF THE RESOURCE DATA

The planning effort began with an assessment of damages from past storm events, along with careful analysis of the hydrology of the area and stream channel hydraulics. In order to assess the economic damages within Buena Vista, it was necessary to determine the level of current damages sustained by properties within the floodplain or that could possibly occur as a result of future storms. This is a two-part effort since both water levels and building elevations must be known.

The water level at any given location is determined by the volume of water for a given flood frequency, the slope and roughness of the channel, and the shape of the channel. A HEC-1 analysis done by the engineering firm of Dewberry & Davis was used to determine the flow discharges for nine subwatersheds within the drainage areas of Indian Gap Run and Noel's Run. An additional five subwatersheds were used to determine discharges within Pedlar Gap. Three subwatersheds were used on Chalk Mine Run. The flood frequencies used were 5, 25, and 100 years.

In order to expedite the planning effort, NRCS teamed up with the Federal Emergency Management Agency (FEMA) to hire a contractor to do the water surface profile analysis. Dewberry & Davis performed the work during the summer of 1996 under a contract with Woodward Clyde Federal Services. Dewberry & Davis used the HEC-2 computer program to determine the water surface elevations at 17 cross-sections on Chalk Mine Run, 37 cross-sections on Indian Gap Run, 20 cross-sections on Noel's Run, and 22 cross-sections on Pedlar Gap Run. Water surface profiles were determined for both the "without project" and the "with project" conditions.

In May of 1995, NRCS survey crews determined the first floor elevation and point of water entry elevation for every building in approximately 114 City blocks. An additional 12 blocks were surveyed in June of 1996. Approximately 900 buildings were surveyed.

For buildings without basements, the water elevations for the three storm frequencies were compared to the first floor elevation of the building. For structures with basements, the point of water entry was used as the point where damage began to occur. Water depth and damage relationships were based on functions provided by the Federal Insurance Administration of FEMA. Personal interviews with selected homeowners and private businesses were used to supplement elevation survey data. These interviews confirmed and quantified damages experienced during previous storm events, e.g., in 1995, 1992, 1985, and 1969.

Of the approximately 900 buildings surveyed, the analysis indicates that approximately 341 are subject to damages from interior stream flooding should a 100 year storm event occur. A 100 year storm event is a major storm and is considered to have a one percent chance of occurrence in any given year. About 277 buildings are projected to be damaged by 25 year storm events (4% chance of occurrence in any given year), and 39 buildings are estimated to be damaged by 5 year storm events (20% chance of occurrence in any given year). The two storms which occurred within a few days of one another in June of 1995 were of a 25 year storm event magnitude.

The properties identified as possibly being subject to future damages represent an approximation based on the data collected and computer simulations of potential storms in the future. Such approximations are estimates based on the best data and analysis tools available. The number of properties and actual damages incurred as a result of future storm events may be more or less than the damages estimated and reported here. This is especially true given the complex and dynamic set of relationships which exist

within the drainageways of these streams. Multiple culverts of varied capacities are typical, as are variations in the channel capacities. In addition, the nature of the upper watershed includes an essentially inexhaustible supply of rock cobbles and other bedload materials such as trees and sediment. Thus, where stream blockages occur is a function of the volume and type of materials which are transported by the storms and where they are deposited. In-stream obstructions cause the water to spill out on to adjacent public and private properties, and damages result.

Of the 341 properties projected to receive damages from 100 year storm events, 34 are within the Chalk Mine Run subwatershed, 223 are within the influence of Indian Gap Run, 23 are associated with Noel's Run, and 60 are expected to be impacted by Pedlar Gap Run. These properties and associated grounds include 246 private residences, 71 businesses, 17 public facilities, 5 churches, 1 professional association, and 1 veterans organization.

The evaluated damage categories for which monetary estimates were made are:

- a) damages to public and private buildings;
- b) building content damages;
- c) private clean-up/debris removal costs;
- d) public infrastructure damage, clean-up/debris removal and repair;
- e) administrative costs borne by Buena Vista and state and federal agencies to respond to emergency circumstances brought about by flooding (overtime, report and grant proposal preparation, processing of flood insurance policy claims, travel and per diem, etc.);
- f) lost business income; and
- g) flood damage cost avoidance expenditures.

In addition, substantial disruption to emergency services is expected to occur with the larger storm events. However, emergency service disruption damages were not quantified and monetized. They weren't quantified because they were presumed to be relatively small in monetary terms, but could potentially cause loss of life. Disruptions of transportation in general, communication lines, and sewer and water services are also potential damages categories for which monetized estimates were not made.

A few explanations follow regarding the flood analysis. The number of properties flooded and the associated dollar value of damages which follow are based on "future without project" (FWOP) assumptions. The key assumption for the FWOP scenario is associated with the hydrologic and hydraulic effects anticipated from known efforts, or soon to be undertaken efforts to expand the intercity stream channel capacities. Buena Vista has already undertaken numerous works of improvement which will affect the intercity stream channel capacities via removal of some culverts, enlargement of others, etc. In addition, State and FEMA funded efforts will likely remove some properties from receiving damages via channel capacity expansion, concrete lining of portions of the channel on Indian Gap Run, and relocation or elevation of some homes. All of these efforts were already known to be underway or planned for implementation and were used in this analysis in order to establish current conditions and trends.

Future without project damages were calculated based on interviews and analysis of the expected physical condition of the channels and their ability to contain drainage volumes during flood stages. The analysis indicates that substantial damages in the City will likely occur in the future primarily due to insufficient interior drainage channel capacity. Damages for the 100 year storm event are estimated to total around \$11,423,000. Damages from 25 and 5 year storm events are estimated around \$7,423,000

and \$484,000 respectively. These are estimated damages due to intercity stream floods only. Damages would be much higher if the Army Corps of Engineer's flood wall were not in place and if the City's concrete lining of Indian Gap Run did not get implemented. Some storm events could conceivably cause simultaneous flooding on both the river and the intercity streams, and the combined waters could exacerbate the depth of flooding and ponding which would occur from intercity stream flooding only.

The FWOP damage estimates for 100 year storm events include approximately \$5.34 million dollars in structure damages (47% of total damages), \$2.41 million dollars in content damages (21%), \$1.87 million dollars in public infrastructure damages (16%), and \$1.14 million dollars in lost business income (10%). The FWOP damage estimates for 25 year storm events include \$3.72 million dollars in structure damages (50% of total damages), \$1.69 million dollars in content damages (23%), \$1.30 million dollars in public infrastructure damages (18%), and \$454,000 in lost business income (6%). FWOP damage estimates for 5 year storm events are estimated around \$484,000 with damages to structures and their contents representing 54% and 22% of total damages respectively. Private clean-up costs and public administrative costs for the 5 year event were less than 2% of total damages in each case. The table below provides a complete breakdown of the estimated damages for all evaluated damage categories and storm events.

Table H - Buena Vista Intercity Stream Flood Damages¹
for the Existing Conditions and Trends (FWOP)
(\$ Millions)

Storm Event (years)	Structure Damages	Content Damages	Debris Removal/ Infrastructure Repair	Lost Business Income	Administrative Costs	Private Clean-up Costs	Totals
100	\$5.34	\$2.41	\$1.87	\$1.14	\$0.361	\$0.305	\$11.42
25	\$3.72	\$1.69	\$1.30	\$0.454	\$0.168	\$0.089	\$7.42
5	\$0.262	\$0.106	\$0.91	\$0.083	\$0.093	\$0.071	\$0.484

The above damages are single event estimations, not annual damages based on annualized projections. However, the single event damage estimates are crucial for building average annual damage projections. These damages form the basis for the construction of a damage frequency curve which relates percent chance of occurrence with specific event level damage estimates. The resulting functional relationship allows the analyst to predict damages for lesser or greater storm events and to annualize damages from all storm events. The average annual damage estimate from all storm events and resulting intercity stream flooding is \$1,356,000. This figure includes \$1,042,000 in average annual damages derived from the damage categories listed above in Table H, and \$314,000 in additional costs estimated to be accruing to private business in Buena Vista as flood damage avoidance costs. The private industry flood damage avoidance costs are costs which occur given past flooding experience and are due to the very real threat of future flooding regardless of the magnitude of predicted future storm events.

¹ Damages evaluated and reported here are the cumulative damages from flooding on the four internal drainageways studied: Chalk Mine Run, Indian Gap Run, Noel's Run, and Pedlar Gap Run.

The estimated damages vary considerably not only by storm event, but also with respect to the different intercity stream subwatersheds. The overwhelming majority of damages from all categories occur within the Indian Gap Run subwatershed. Structural damages within Indian Gap Run constitute 72% of the total structural damages for the 100 year storm event (\$3,866,000 of \$5,337,000). Predicted structural damages from the 100 year storm event in the Chalk Mine Run and Pedlar Gap Run subwatersheds amount to 8% and 7% of total structural damages respectively (\$803,000 combined). Structural damage estimates for the 100 year storm event within the Noel's Run subwatershed are more substantial and make-up the remaining 12.5% (\$669,000) of total structural damages.

Damages to public infrastructure and the costs for clean-up and repair of roads, culverts, ditches, etc. were greatest in the Pedlar Gap and Noel's Run subwatersheds (\$1,154,000 combined). These two types of damages represent 62 percent of the total projected damages to public infrastructure. Damages and associated repair costs to public infrastructure for the 100, 25 and 5 year storm events are projected around \$1,867,000, \$1,303,000, and \$91,000 respectively. Actual experience from the June 1995 floods resulted in a documented \$1,415,000 in public infrastructure damages, clean-up and repair costs. Damages in the future from comparable storms would be less because of the expected benefits from the City's project to line much of Indian Gap Run with concrete. In addition, numerous culverts and bridges on all four of the intercity streams have been removed and will not be replaced. Therefore, they will no longer receive damages and require clean-up and repairs.

The largest losses in foregone business income occur within the Indian Gap Run subwatershed (approximately \$806,000 or 71% of the losses for the 100 year storm event). Business income losses in the Pedlar Gap Run subwatershed represented about 21% (\$242,000) of the total estimated losses in this category resulting from the 100 year storm event. Noel's Run (\$7,500 business income losses) and Chalk Mine Run (\$83,000) are projected to receive substantially less business income losses because they are predominantly residential areas.

In summary, for the FWOP condition, damages from 100 year storm events are largest for the building structures damage category (\$5.34 million), and proceed in descending order to building contents (\$2.41 million), private business income loss (\$1.14 million) and public infrastructure (\$1.87 million). With respect to the subwatersheds, overall damages are greatest within Indian Gap Run (62% of total damages), with Pedlar Gap Run (14%) a distant second place, and Noel's Run (13%) and Chalk Mine Run (9%) with far less damages. Other damages within the City which are unassigned to these four subwatersheds would account for the remaining 2 percent of total damages.

FORMULATION AND COMPARISON OF ALTERNATIVES

Formulation Process

The alternatives for each subwatershed, as well as the overall watershed wide alternatives were formulated based on several criteria. The criteria were: a) an analysis of the hydraulics and hydrology data for the future without project condition and each alternative, b) practical interpretations regarding which actions made sense from an engineering perspective, c) economic feasibility and common sense observations, d) local acceptability, e) environmental issues and considerations, f) cultural resource (archeological and historic) concerns, and g) whether or not a given action was complementary to existing and planned investments in works of improvements by the Army Corps of Engineers (Maury River Floodwall), Buena Vista (Indian Gap Run channel improvements through installation of a concrete lining and bridge and culvert improvements throughout the four subwatersheds), and the City, FEMA, Virginia Department of Emergency Services and the Central Shenandoah Regional Planning District Commission plans to buyout, relocate and or floodproof selected homeowners. Practical effectiveness, complementarity to other investments, economic feasibility and local acceptability were the final test in determining whether or not an individual action was included or excluded from an alternative. These same criteria were also used to determine when to stop adding increments of treatment to a given alternative.

The following alternatives were considered during the initial planning period:

1. No action
2. Possible structural measures such as:
 - Debris basins (earth and concrete)
 - Debris diverters
 - Channel improvements
 - Channel crossing improvements (culverts and bridges)
 - Remove crossing (close road)
 - Low flow crossing
 - Enlarge opening
 - Floodwater retarding structures
 - Berms/floodwalls
3. Possible nonstructural measures such as:
 - Relocation/zoning
 - Floodproofing
 - Land treatment
 - Stormwater management

Formulation and Evaluation of Non-Structural Alternatives

The formulation and evaluation of possible actions and sets of actions (alternatives) included an assessment of the use of non-structural measures to mitigate flood damages. The non-structural measures that we investigated included: a) buy-out, b) relocation, c) elevation, d) flood-proofing, e) flood barriers (walls and dikes), and f) early warning/evacuation systems. All of these measures, except for flood-proofing and early warning systems, are very expensive and proved to not be feasible from an

economic benefit/cost perspective on a wholesale basis because the properties in Buena Vista tend to be valued at levels far below national, state and even county-wide averages. This is especially true for properties within Chalk Mine Run, Reservoir Hollow and Pedlar Gap Run. In addition, these alternatives have other considerations which disfavor widespread use of them to reduce future damages.

Buy-out requires that suitable and affordable alternative housing be found by the bought-out property owner in the market of their choice, which isn't always the case in small towns like Buena Vista. Relocation requires movement of the property to a site (open lot) outside of the floodplain. Relocation also involves expenses for temporary housing (usually in motels) and can very quickly escalate to significant amounts. Buy-out and relocation both can have a substantial social cost associated with moving people from their homes. This can be especially true if the involved are long-term residents and elderly. Many residents within the Buena Vista floodplain are elderly, low income individuals and long time residents for whom relocation could be quite traumatic, especially if public condemnation was used to force them to move. Voluntary participation in buy-out/relocation is absolutely preferable, but is unlikely to be adopted on a widespread basis simply because most people prefer the known to the unknown.

Elevation of properties makes sense when the amount of elevation isn't extreme and when the act of elevating the property doesn't cause structural damage to the property. Older homes tend to receive greater structural impacts and need more repairs as a result of elevation. Elevation can also be quite expensive when brick, stucco or slab-on-grade structures are involved. Brick and stucco veneers may need to be removed and disposed of, then replaced after elevation. Frame houses over a crawl space tend to be the easiest and least expensive to elevate. Homes with basements tend to be more expensive to elevate because their utilities are usually in the basement. Many of the homes in Buena Vista have basements or cellars and stucco facades, most tend to be fairly old, low valued, are not in the best of physical conditions and consequently would not make good candidates for elevating.

There are two types of floodproofing, wet and dry. Wet floodproofing allows internal flooding to continue occurring, but increases the property's ability to resist damages. Wet floodproofing can work well for unfinished basements and garages, but isn't commonly thought of as useful for the main living areas of a property. Dry floodproofing involves a series of measures which are aimed at keeping flood waters out. Dry floodproofing can work well and be cost effective when the buildings involved are not subject to extensive hydrostatic pressure and other forces (e.g. subsurface soil pressure, and debris and cobble moved by floodwaters) against the foundation and exterior walls and when extensive strengthening measures are not required. Unfortunately, the foundations of properties within floodplains commonly are subject to significant hydrostatic and soil pressures from subsurface flows during minor storm events, and surface as well as subsurface pressures during larger storm events. Thus, this alternative offers limited potential for use on the large number of potential properties in Buena Vista.

Early warning systems are designed to function with automated stream gauges and local emergency preparedness planning for organizing and carrying out evacuations. They work best in situations where the type flooding that usually occurs involves time lags between the early indications of rising waters and when flooding will occur so as to allow for emergency response. The fact that the upper watersheds of the four intercity streams above Buena Vista are extremely steep, and the distance between the City and the upper watersheds is relatively short excludes an early warning system from being considered as a viable option. In addition, evacuation would be difficult for Buena Vista's elderly floodplain residents.

Flood barriers (masonry walls and earthen dikes) can be very effective at preventing inundation, as a defense against unequal hydrostatic pressure situations and as a means for deflecting debris away from an individual or group of structures. Earthen dikes are often infeasible due to the large surface area which is typically required for their installation. Typical costs for flood barriers range in between the least and most expensive non-structural alternatives. Generally speaking, floodproofing is the least expensive and buyout or relocation tend to be the most expensive non-structural alternatives.

Non-structural measures were judged in the case of Buena Vista to not make sense on a widespread basis because of the above discussed treatment characteristics and site conditions in Buena Vista. The large number of properties involved, the varied levels of risk for future damages from one property to the next, and the potentially very high costs associated with the most effective nonstructural measures (buy-out, relocation, and/or elevation), lead our team to conclude that these measures make the most practical and economic sense when evaluated on a case by case and site specific basis. Assuming a very conservative average cost of \$35,000 per home would have resulted in an estimated project cost for non-structural measures of over \$9,625,000, just to protect the 275 properties affected by the 25 year storm event. This alternative would likely cost much more because the average cost for commercial properties would be much more than the \$35,000 per structure assumed here. Using the same conservative \$35,000 per home cost for non-structural alternatives, 100 year storm event protection would cost over \$11,900,000. Buena Vista is a relatively small City both in terms of it's physical area occupied and with respect to it's population. Thus, finding sufficient sites for new residences and relocations for every structure located in the floodplain would prove to be completely impractical.

Therefore, in collaboration with the City of Buena Vista, the Central Shenandoah Planning District Commission (PDC), Virginia Department of Emergency Services and Federal Emergency Management Agency (FEMA), a strategic approach was initiated to address the nonstructural alternatives. A pool of potential candidates for voluntary implementation of nonstructural measures was targeted. The houses selected were deemed at greatest risk for future flood damages based on past history and a review of the hydrology and hydraulics models. By using NRCS planning analysis and data, a total of 39 potential properties were identified as good candidates to meet the economic defensibility criteria for evaluation and inclusion in the hazard mitigation grant project. This effort is intended to complement the broader watershed-wide NRCS project proposal from a smaller scale strategic properties focus whereby the properties at greatest risk from recurrent flooding are targeted for buy-out, relocation and/or elevation.

The non-structural hazard mitigation project was an outgrowth of the coordinated whole-watershed planning process. This approach was judged by our Planning Team, the local sponsors and the Virginia Department of Emergency Services, to make the most sense to utilize non-structural alternatives to the maximum extent practical. These investments are considered non-project actions from the PL-566 perspective and thus the associated benefits and costs have been excluded from the proposed Plan-EIS.

The PDC, Virginia Department of Emergency Services and FEMA are moving forward with implementation of this nonstructural measures strategy. NRCS subsequently limited the scope of additional treatment alternatives to structural measures which would address future flooding on a widespread scale and complement the non-structural actions.

Formulation of Structural Alternatives

This report refers to structures that remove sediment, cobbles and woody debris from the flood flow as debris basins. A typical debris basin will be an off-stream structure that is designed to slow the velocity of storm flows and allow the debris to drop out of the water. The water would then rejoin the channel without the debris. The base flow, up to a 1-1.8 return interval event (bankfull), would always be carried within the main channel. A concrete cutoff wall would be used to force storm flows to exit the main channel and pass through the debris basin. The base flow will pass through a trash rack into a concrete pipe through the cutoff wall. A bench, or sill, will be placed at the bankfull elevation at the inlet of the debris basin. Scale modeling will be used to determine the final design(s) of these structures. All of the proposed debris basins allow easy access for earth moving equipment.

A typical debris diverter is a metal rack or frame set into the stream above a stream crossing. It would trap larger debris and prevent it from clogging the culvert or bridge. The amount of maintenance required for this structure and the relatively small amount of debris that would be trapped make installation of this practice impractical for this watershed. Therefore, debris diverters were dropped from further consideration by the Planning Team.

Channel improvements include changing the cross-section, slope, and/or lining material of a stream reach. There are two goals in stream channel improvements: 1) maintain the natural characteristics of the stream and 2) provide the maximum capacity possible. This will be accomplished by a channel-within-a-channel type design. The "natural" stream will be designed using fluvial geomorphology and will accommodate the "bankfull" event (approximately 1-1.8 year return frequency). Typically, the "natural" stream will be bounded on one side by the stream bank and on the other side by an earthen bench set at the bankfull elevation. The width of the bench will determine the additional capacity of the entire channel.

To the extent possible, the work done in the stream will be done during the season in which the channel is dry. The streambanks will be armored where needed to protect against scouring. One of the possible alternatives for the armoring is the use of interlocking concrete grids. Many of these grids have openings that can be filled with soil and vegetated. This will both protect the bank and provide a more attractive appearance.

Channel crossing improvements are made when the size or the configuration of the culvert or bridge causes a constriction in the flow. One option for improvement is to remove the culvert or bridge and close the road. Another option is to replace the crossing with a low-water crossing. Neither of these options is acceptable to the community. The third option is to replace the crossing with a larger structure. An example of this would be a hy-span type bridge that has no piers in the channel. Large parallel box culverts that closely match the channel capacity are another option.

The option of constructing detention facilities upstream of the town to reduce peak discharges and gather sediment was evaluated. With the steep mountains, the volume available for detention was found to be insufficient to reduce peak discharges significantly. These structures would also be classified as "High Hazard", and as such, are unacceptable to the City residents. Therefore, detention structures were dropped from further consideration by the Planning Team.

Floodwalls and berms were considered for the locations where the flow area needed to be constricted for a short reach of the stream. For the purposes of this study, only small structures, less than 4 feet high,

were considered. The floodwalls were modeled as free-standing concrete walls approximately two feet thick. Berms are typically made of earth with 2:1 side slopes. Earth structures have a relatively large “footprint” on the ground and require more land than a concrete floodwall. The aesthetics are another factor in the selection of the structure used.

Relocation and zoning are ways to keep the floodplain free of obstructions and reduce the threat to life and property. The City is pursuing the use of FEMA’s Flood Mitigation Program to possibly acquire, relocate or elevate repetitive loss structures. Therefore, NRCS dropped these non-structural alternatives from further consideration for implementation with PL-566 funds.

Floodproofing may be appropriate for buildings that receive relatively small amounts of water during a flood. This practice could include elevation of the building, closing the point of water entry, or relocating appliances from basements to upper levels. This may be appropriate for individual structures, but was not considered on a wholesale basis as a solution to the flooding problem in Buena Vista.

Land Treatment practices are typically used in rural watersheds where changes in the activities in the watershed tend to increase the quantity of water and decrease the quality. For the Buena Vista watershed, the land use will probably experience little change since most of the headwaters area is in the George Washington and Jefferson National Forests.

Stormwater management is a way to control the quantity of water that is contributing to the stormwater discharge. As the amount of impervious surfaces increases through the installation of roads and roofs, the amount of water that runs off the land increases. In many places, the local ordinances require developers to temporarily detain any runoff that is greater in quantity than the predevelopment runoff.

Description of Alternative Plans

After much debate and discussion, along with hydrology and hydraulic modeling, it was decided that the most probable solutions were related to two major categories of structural practices:

- 1) Stream Channel Capacity Enhancement, and
- 2) Debris Removal

These two umbrella solutions made the most sense from a technical and practical perspective. The selected measures under the umbrellas were the following:

- 1) Construct debris basins;
- 2) Replace/enlarge/remove culverts and/or bridges;
- 3) Construct flood walls and berms;
- 4) Improve/realign stream channel;
- 5) Replace railroad bridges; and
- 6) Increase channel gradient.

It was decided that these structural measures in combination, strategically placed throughout the four interior streams, would significantly address the flooding problem in Buena Vista. The Planning Team then looked at each stream individually to determine where these structural measures would best be located in order to fit together into an overall flood control plan.

After each stream was evaluated and modeled separately, the Planning Team packaged the various structural measures for each stream into four alternatives. These alternative packages were discussed

with the project sponsors and met the acceptability test. These alternatives are shown below and are evaluated and described in more detail in later sections of the report.

Alternative 1 - Stream Channel Capacity Enhancement and Debris Removal - Level I.

Alternative 2 - Stream Channel Capacity Enhancement and Debris Removal - Level II.

Alternative 3 - Stream Channel Capacity Enhancement and Debris Removal - Level III.

Alternative 4 - No Action

Evaluation of Alternative Plans

Some of the practices proposed did not affect the hydraulic modeling used in the analysis. Those practices were analyzed separately. The following measures were evaluated to control the flooding:

1. Increase flow capacities
 - a. Resize culverts and bridges
 - b. Enlarge stream channels
2. Restrict flow area
 - a. Berms
 - b. Small floodwalls

Modeling

There were two computer models used in the analysis of the four Buena Vista watersheds. The first one, HEC-1, is a program written by the U.S. Army Corps of Engineers Hydrologic Engineering Center that is used to calculate the amount of water that would run off from the watershed during a given storm event. This program evaluates the slope of the land, the soils, and the land use in order to compute the discharge for each storm. For this report, the five, twenty-five, and one hundred year storm discharges calculated by Dewberry & Davis from the HEC-1 model were used in the HEC-2 model to determine the water surface elevations throughout each watershed. The HEC-2 model was also written by the Hydrologic Engineering Center. It uses the discharge for the selected storm event and the shape, size, roughness, and slope of the channel to estimate the elevation of the water surface at each cross-section in the channel. It also evaluates each stream crossing to see what effect it has on the flow.

The HEC-2 computer model can be used to simulate two different flow conditions: subcritical flow and supercritical flow. For channels with earth or riprap linings, the flows are typically slower and deeper than for smoother channel linings, and are best described by the subcritical model. The concrete channel from Cedar Avenue to Chestnut Avenue is very smooth, and its fast, shallow flows are best described by the supercritical model. The transition from subcritical to supercritical will occur if there is a change in grade from a flatter grade to a steeper grade. For the faster supercritical velocities, the flow area will be smaller, and the water will stay in the concrete channel, for the most part. The transition from supercritical to subcritical flow will occur if the grade is flattened or if a constriction causes the flow to slow down. In this transition, the flow will abruptly change from fast, shallow flow with a relatively small cross-sectional area to slow, deep flow with a relatively large cross-sectional area. This phenomenon is called a hydraulic jump.

Project Descriptions

The quantities, elevations and sizes listed in the project descriptions are based on preliminary analysis and should be used for planning purposes only. These criteria could change during final design.

The following provides a breakdown of each individual stream and describes the proposed plan including a detailed description of each considered measure.

Chalk Mine Run

Chalk Mine Run and its tributary, Washer Hollow, both experience flooding along the length of the channel. This is due primarily to lack of channel capacity and to stream crossing constrictions. The lower end of Chalk Mine Run also experiences flooding from the Maury River. (The U.S. Army Corps of Engineers floodwall begins downstream of the outlet of Chalk Mine Run.) Most of the road and railroad crossings along this stream are relatively large. The exceptions to this are the culvert at Rockbridge Avenue and the bridge to Fitzgerald's Lumber Plant. Woody and rock debris often contribute to the flooding by blocking the smaller stream crossings.

The water surface elevation in the lower end of Chalk Mine Run will vary with the elevation of the water in the Maury River. To judge the effect of these elevation changes, several different starting elevations were modeled. In each case, the water surface profiles were identical above the Route 60 bridge. This leads to the conclusion that the flood elevations on Chalk Mine Run will not be impacted by the water surface elevation in the Maury River for the size of storm that will produce a 100 year storm event.

Watershed Description of Chalk Mine Run

Drainage Area: 3847.3 acres (6.01 sq. mi.)

Woods: 3469.2 acres (90%)

Residential: 221.5 acres (6%)

Industrial: 116.3 acres (3%)

Commercial/Business: 40.3 acres (1%)

Channel Length Modeled:

Main: 7735 linear feet

Washer Hollow Tributary: 980 linear feet

Discharge at confluence with the Maury River:

5 year frequency event: 2165 cfs

25 year frequency event: 5670 cfs

100 year frequency event: 8480 cfs

Problem Description of Chalk Mine Run

For the purposes of the evaluation, Chalk Mine Run was divided into three reaches based upon the three primary damage areas. Overland flow, ponding, and debris are the primary damage sources.

From the Norfolk Southern Railroad bridge downstream to the confluence with the Maury River (1475 linear feet), there is ponding due to the lack of channel grade and capacity.

- High water surface elevations on the Maury River will increase the ponding.

From the Norfolk Southern Railroad bridge upstream 1220 feet, the channel capacity is inadequate to carry flood flows.

- Excess water from the channel floods Route 60 at the railroad bridge.
- The culvert under Rockbridge Avenue is too small.

From upstream end of the second section to the confluence of Chalk Mine Run (5040 linear feet) and the tributary Washer Hollow (980 linear feet), the channel capacity is inadequate to carry flood flows.

- The bridge to lumber plant is too small.

Potential Solutions for Chalk Mine Run

The possible solutions considered include:

- channel enlargement
- replacement of bridges
- installation of berms
- enhancement of existing berms
- flood retention structures
- stormwater overflow areas
- debris basins

Alternatives Considered for Chalk Mine Run

Alternative 1 for Chalk Mine Run:

- Increase channel capacity for 1190 linear feet immediately above Norfolk Southern bridge (305 linear feet of riprap, 885 linear feet of earth channel)
- Replace Rockbridge Avenue culvert with a bridge
- Increase channel capacity for 350 linear feet going downstream on main channel behind shopping center from the confluence of Washer Hollow and Chalk Mine (earth channel)
- Increase channel capacity on Washer Hollow upstream of confluence with Chalk Mine Run for 315 linear feet (140 linear feet of earth channel, 175 linear feet of riprap)
- Increase storage capacity of channel for larger storm events by excavating material from existing basin area above lumber plant bridge
- Replace lumber plant bridge with a larger structure
- Raise existing berm behind hotel to provide additional protection for shopping center (water will remain in channel area rather than break over into parking lot)
- Construct a debris basin below the Catalpa Street bridge for the purpose of trapping sediment and debris during smaller storm events.

Alternative 2 for Chalk Mine Run:

Same as Alternative 1 with the following addition:

- Increase channel capacity below Norfolk Southern bridge for a distance of 825 linear feet (545 linear feet of riprap channel and 280 linear feet of earth channel)

Indian Gap Run

When this study was initiated, there were two primary damage areas along Indian Gap Run. Below Walnut Avenue, the damage occurred from water that was ponded due to outlet constrictions. In the upper part of the channel, damages were from overland flow that occurred when water left the channel at Hawthorne Avenue and Cedar Avenue, and flowed down Twentieth Street instead of rejoining the channel. Since this study began, the City has received a grant that will enable them to line the stream channel with concrete from Cedar Avenue to Chestnut Avenue and remove most of the channel constrictions within that reach. The channel lining and removal of the stream constrictions will significantly reduce the amount of damages from overland flooding. This concrete channel, as modeled by City consulting engineering company Mattern & Craig, used the supercritical flow regime of the HEC-2 model. However, there will still be some overland flow down Twentieth Street from water which escapes the channel above Cedar Avenue and is unable to rejoin the stream. Some additional overland flow will occur below Walnut Street where the grade change in the concrete channel causes a hydraulic jump. Additional overland flow damages will occur where rocks and woody debris block the stream crossings and the water is forced out of the channel.

There are three main factors that contribute to the ponding in the lower part of Indian Gap Run. The primary problem is that the flow capacity of the Norfolk Southern railroad bridges is too small. The downstream railroad bridge has a span of only 18 feet, and although the total span of the upstream bridge is 77 feet, the effective span is only 44 feet. The water velocity is significantly reduced when these constrictions are reached. A second problem associated with the railroad crossing is that the railroad embankment is about 6 feet higher than the elevation of the commercial area of the City. This further reduces the available flow area and the flow velocity. The third factor is that the grade of the channel and the floodplain is very flat. This causes additional reductions in the flow velocity. With the slower velocities, more cross-sectional area is needed to carry the flow. The proposed practices are designed to increase the flow capacity and velocity, and thereby, reduce the damage area.

The Magnolia Avenue bridge, and the Forest Avenue and Chestnut Avenue culverts will be inundated by ponded water during the 25 and 100-year floods. The Virginia Department of Transportation (VDOT) plans to replace the Magnolia Avenue bridge. Because of the high backwater, increased capacity at the bridge will not improve the flooding conditions for a storm greater than a 25-year event. However, the new crossing should be sized to provide at least as much capacity as the Forest Avenue culvert but be no larger than the five 10'x10' box culverts at the floodwall. At Forest Avenue, Indian Gap Run passes through a triple 9' x 3.5' box culvert and, at Chestnut Avenue, a triple 10' x 3.5' box culvert. During flooding events, a large percentage of the flow passes over the roads. It is impractical to contain this flow within the culverts because of the high tailwater. During the 100-year flood, this tailwater submerges the roadway. Therefore no alterations are proposed to increase the capacity of these culverts.

The solutions to the flooding problem along Indian Gap Run can be divided into three parts: reducing the ponding area, maintaining the flow within the channel above Cedar Avenue, and eliminating blockages from debris.

Watershed Description Of Indian Gap Run

Drainage Area Above Confluence with Noel's Run: 1051.5 acres (1.64 sq. mi.) (Based on 1993 computations)

Woods: 873.3 acres (83%)

Open: 9 acres (1%)

Residential: 169.2 acres (16%)

Indian Gap was modeled as a single channel from the headwaters to the confluence with the Maury River. Noel's Run is modeled as a tributary.

Drainage Area of Watershed to Confluence with Maury River:
2839.9 acres (4.44 sq. Mi.)

Channel Length Modeled: 7700 linear feet

Discharge at confluence with Maury River:

5 year frequency event: 1652 cfs

25 year frequency event: 4019 cfs

100 year frequency event: 5942 cfs

Problem Description Of Indian Gap Run

There are three areas where flooding from Indian Gap Run occurs.

Above Cedar Avenue, water escapes from the channel and causes damages along Twentieth Street.

- The channel capacity is inadequate.
- The water moves directly down the hill and is unable to rejoin the channel.

Flooding also occurs in the lower section of the concrete channel.

- Buena Vista's design for the planned concrete channel from Cedar Street to Chestnut Street was used in the "Future without Project" and the "Future with Treatment" model.
- Flooding along most of the channel will be negligible after the concrete channel is in place.
- The HEC-2 model, in supercritical flow, shows that there will be two hydraulic jumps in the concrete channel below Walnut Avenue.

However, the vast majority of the damages occur from ponded water in the lower part of the watershed.

- There are two railroad bridges just above the floodwall gates. The downstream bridge is less than 18 feet wide and is a significant constriction to the flow.
- The upstream railroad bridge and its embankment also are a constriction.
- The gates through the floodwall are flap gates. As such, they will allow the free outlet of water from Indian Gap Run unless the Maury River is at a flood elevation greater than that of the interior stream. At that point, the water will be diverted into the interior drainage channel.

The culverts and bridges along the channel were modeled as follows for the "Future without Project" condition:

- Norfolk & Western Railroad: unchanged
- Norfolk & Southern Railroad: unchanged
- Route 501 (Magnolia Avenue): unchanged
- Forest Avenue: unchanged
- Chestnut Avenue: unchanged
- Seventeenth Street: unchanged
- Walnut Avenue: culvert removed
- 18th & Maple: replaced with bridge
- Birch Avenue: culvert removed
- 19th & alley: replaced with bridge
- 20th Street: culvert removed
- Cedar Avenue: new precast bridge

Debris blockages were not modeled due to the difficulty of predicting which combination of culverts would clog in a given storm. The channel was assumed to be free of debris.

Potential Solutions for Indian Gap Run

The possible solutions considered include:

- replace one or both Norfolk Southern railroad bridges with another bridge
- replace the Norfolk Southern railroad bridges with 5 10'x10' box culverts
- increase channel capacity below Chestnut Avenue
- replace Magnolia Avenue bridge
- replace Forest Avenue culvert
- construct berms along the channel from Chestnut Avenue to railroad
- realign Indian Gap Run below Magnolia Avenue
- construct floodwall along channel at Hawthorne
- construct debris basins at the ballfield and at 19th Street, 17th Street, Chestnut Avenue, and Forest Avenue
- regrade Cedar Avenue to drain toward channel

Alternatives Considered For Indian Gap Run

Alternative 1 For Indian Gap Run:

- Replace the two railroad bridges with five 10'x10' box culverts, 130 feet long.
- Install a debris basin at the ballfield at the end of 21st Street.
- Install a 3' high floodwall along the channel at Hawthorne Avenue (500 feet).
- When the new bridge is installed at Cedar, grade the road so that flow that escapes the channel will be directed back in before it reaches Twentieth Street (this will be done by the City).

Alternative 2 for Indian Gap Run:

Same as Alternative 1 with the following additions:

- Add approximately 300 feet of channel improvements below Magnolia Avenue and 700 feet of channel improvements above Magnolia Avenue
- Replace the Magnolia Avenue bridge with 4 8'x6' box culverts. Approximately 150 feet of Noel's Run will be improved to match the new grade on Indian Gap Run.
- Although the channel realignment below Magnolia was not modeled, it seems to be feasible. However, the grade of the realigned channel would change only slightly, and therefore, would not significantly improve the velocity of the water. Due to the known industrial contamination of the site, it may not be practical to build a new channel. Certification from the City stating that the site is free from contamination will be required before any NRCS involvement in the realignment of this channel.

Note: After the channel constriction at the outlet is removed by replacing the railroad bridges with box culverts and the channel is enlarged below Chestnut Avenue, there will still be a significant amount of ponding in the lower end of Indian Gap Run. It was determined that it is neither practical nor economically feasible to construct berms to contain the additional water due to the volume of the water involved and the size of the berms that would be required.

Noel's Run

The dominant cause of damages in the Noel's Run watershed is overland flow. Noel's Run has a 400 foot wide 100-year floodplain that inundates numerous residential structures. However, unlike Indian Gap Run where the water is diverted away from the channel, the flow continues along the stream channel. Several projects have already been constructed that increased the stream capacity. Except for a 300 foot segment of stream upstream of 14th Street that has not yet been enlarged, further enlargement of the stream capacity would not impact enough structures to warrant the cost. Rocks and woody debris blockages occur frequently, and further reduce the stream capacity.

Watershed Description of Noel's Run

Drainage Area: 1427.4 acres (2.23 sq.)

Woods: 1369 acres (96%)

Residential: 58.4 (4%)

Channel Length Modeled: 5970 feet

Discharges at the confluence with Indian Gap Run:

5 year frequency event: 616 cfs

25 year frequency event: 1721 cfs

100 year frequency event: 2619 cfs

Problem Description of Noel's Run

For Noel's Run, overland flow occurs along the entire length of the channel. Additional damage is caused by the ponding at the lower end of the stream below Chestnut Avenue.

From Pine Street to Chestnut Avenue, water escapes from the channel and flows overland in a path that is parallel to the channel.

- The capacity of the stream is not adequate to carry the water during storm events.
- Water that escapes from the channel does not tend to return to the channel.
- There is an abundance of debris in the channel that further reduces the channel capacity.

From Chestnut Avenue to the confluence with Indian Gap Run, the flooding is caused by ponded water.

- In the "Future without Project" condition, the ponding at the lower end of the channel is primarily caused by backwater from Indian Gap Run.
- The ponding from Indian Gap Run is masking the actual flooding that is occurring below Chestnut Avenue from Noel's Run. When the ponding from Indian Gap Run is reduced by modeling Alternative 2, then other causes of flooding are revealed. From Chestnut Avenue to Forest Avenue, overland flooding occurs parallel to the channel. However, the extent of the overland flow is greater below Chestnut Avenue than it is above Chestnut Avenue. The flatter grade that begins at Chestnut Avenue causes the water to flow slower and deeper than it does on steeper grades. From Forest Avenue to the confluence with Indian Gap Run, ponding from Indian Gap Run is still dominant.
- There may be a channel constriction at Forest Avenue that will continue to be masked by the ponded water.

Potential Solutions for Noel's Run

The possible solutions considered include:

- debris basins:
 - headwaters - at the end of Pine Street
 - intermediate - at the end of Oak Avenue
 - intermediate - upstream of Maple Avenue
- channel enlargement

Alternatives Considered for Noel's Run

Alternative 1 for Noel's Run:

- Install debris basins.

Note: Although the channel improvements that were modeled were adequate to carry the storm flows, the overland flow from upstream areas did not return to the channel where it could be contained. Therefore, no channel improvements are planned.

Pedlar Gap Run

The flooding in the Pedlar Gap Run watershed is similar to that of the other streams in Buena Vista. There is ponding in the lower end of the channel, overland flow along the length of the channel, and debris blockages throughout. Additional ponding occurs in the upper part of the watershed at some of the culverts. Much of the damage can be attributed to the stream crossings that are too small to pass the increased discharges caused by changes in land use.

Upstream of Woodland Avenue, several projects to increase stream capacity are in place and functioning properly. There were no additional improvements planned for these reaches.

Watershed Description Of Pedlar Gap Run

Drainage Area: 1299 acres (2.03 sq. mi.)

Woods: 1172 acres (90%)

Residential: 120 acres (9%)

Open: 5 acres (0.4%)

Industrial: 2 acres (0.2%)

Channel Length Modeled: 8395 feet

Discharge at confluence with Maury River:

5 year frequency event: 621 cfs

25 year frequency event: 1698 cfs

100 year frequency event: 2607 cfs

Problem Description Of Pedlar Gap Run

The majority of the damages caused by flooding from Pedlar Gap Run are caused by ponding in the lower end of the channel. However, flooding does occur along the length of the channel due to changes in stream capacity. Debris blockages contribute to the reduction in capacity.

Overland flow occurs from Third Street to just below Ninth Street.

- The channel capacity is not adequate to carry the flows during storm events.
- Most of the stream crossings on this channel do not have adequate capacity to transport flows from storm events.

Upstream of the Third Street crossing, the water is ponded.

The abandoned bridge below Linden Avenue and the Norfolk Southern Railroad crossing both cause the water to be ponded during the larger storms.

Potential Solutions For Pedlar Gap Run

The possible solutions considered include:

- channel enlargement
- replace the railroad culvert with a bigger structure
- remove culverts and close roads
- replace culverts with hy-span type bridges
- install debris basins

Alternatives Considered For Pedlar Gap Run

Alternative 1 for Pedlar Gap Run:

- Replace the railroad culvert with 2 10'x10' box culverts and lower the invert elevation by 5 feet. The new culverts would be installed parallel to the existing culvert. Approximately 120 linear feet of channel would be realigned.
- Remove the Linden Avenue culvert and replace it with a hy-span type bridge deck.
- Remove the abandoned yard bridge.
- Install 733 linear feet of channel improvement. This includes 120 feet of channel realignment.
- Install a drop inlet at the 9th Street culvert.
- Install one debris basin above 2nd Street and another one above 5th Street.

On Pedlar Gap Run, the configuration of the outlet is such that it is possible to lower the outlet by approximately 5 feet without causing a backwater effect within the stream. This will increase the average slope of the channel and increase the velocity. The proposed channel improvements will also increase the cross-sectional area of the channel. These two changes will have the effect of minimizing out-of-bank flow along the improved length of the stream.

Alternative 2 for Pedlar Gap Run:

Same as Alternative 1 with the following additions:

- Remove the inlet constriction on the 9th Street culvert.
- Remove the Woodland Avenue culvert and replace it with a hy-span type bridge.
- Improve the channel from 9th Street to a point approximately 250' above Woodland Avenue (950 linear feet).
- Install a 4' high floodwall above Magnolia Avenue for approximately 250 feet.

Alternative 3 for Pedlar Gap Run:

Same as Alternative 1 with the following additions:

- Replace the Magnolia Avenue bridge with 3 10'x8' box culverts.
- Remove the 9th Street culvert and replace the culvert with a hy-span type bridge. (The outlet structure from Alternative 1 would not be needed.)
- Remove the Woodland Avenue culvert and replace it with a hy-span type bridge.
- Improve the channel from 9th Street to a point approximately 250 feet above Woodland Avenue (1095 linear feet). The grade of this channel will be different from Alternative 2 due to the removal of the outlet structure and the replacement of the Magnolia Avenue culvert.

General Technical Considerations

1. Although a trapezoidal shape was modeled in the channel improvements, it is not the optimum shape for a good channel design. A low flow channel should be provided in each stream to maximize the sediment carrying capacity of base level flows.
2. Storm water management to maintain existing discharge levels is critical.
3. Any debris basins installed should be well maintained to get the maximum benefit.
4. It would be appropriate to restrict additional construction in the 100 year floodplain.

Economic Considerations

The following table displays all cost categories by subwatershed for each of the three evaluated action alternatives.

Table I - Evaluated Action Alternatives and their Associated Costs

Subwatershed	Alternative #1	Alternative #2	Alternative #3
Chalk Mine Run			
Construction Cost:	\$1,188,000	\$1,343,000	\$1,343,000
Property Rights:	\$ 157,000	\$ 196,000	\$ 196,000
Utility Relocations:	\$ 10,000	\$ 15,000	\$ 15,000
Local Administration:	\$ 10,000	\$ 10,000	\$ 10,000
Local Technical Assistance:	\$ 15,000	\$ 15,000	\$ 15,000
NRCS Administration:	\$ 25,000	\$ 25,000	\$ 25,000
NRCS Technical Assistance:	\$ 61,000	\$ 61,000	\$ 61,000
Total Estimated Cost:	\$1,466,000	\$1,666,000	\$1,666,000
Indian Gap Run			
Construction Cost:	\$1,758,000	\$2,015,000	\$2,015,000
Property Rights:	\$ 13,000	\$ 67,000	\$ 67,000
Road Relocations:	\$ 7,000	\$ 7,000	\$ 7,000
Utility Relocations:	\$ 0	\$ 15,000	\$ 15,000
Local Administration:	\$ 15,000	\$ 15,000	\$ 15,000
Local Technical Assistance:	\$ 23,000	\$ 23,000	\$ 23,000
NRCS Administration:	\$ 50,000	\$ 50,000	\$ 50,000
NRCS Technical Assistance:	\$ 122,000	\$ 122,000	\$ 122,000
Total Estimated Cost:	\$1,987,000	\$2,314,000	\$2,314,000
Noel's Run			
Construction Cost:	\$ 526,000	\$ 526,000	\$ 526,000
Property Rights:	\$ 52,000	\$ 52,000	\$ 52,000
Utility Relocations:	\$ 10,000	\$ 10,000	\$ 10,000
Local Administration:	\$ 5,000	\$ 5,000	\$ 5,000
Local Technical Assistance:	\$ 8,000	\$ 8,000	\$ 8,000
NRCS Administration:	\$ 20,000	\$ 20,000	\$ 20,000
NRCS Technical Assistance:	\$ 31,000	\$ 31,000	\$ 31,000
Total Estimated Cost:	\$ 651,000	\$ 651,000	\$ 651,000
Pedlar Gap Run			
Construction Cost:	\$ 901,000	\$1,484,000	\$1,971,000
Property Rights:	\$ 69,000	\$ 106,000	\$ 103,000
Utility Relocations:	\$ 20,000	\$ 50,000	\$ 50,000
Local Administration:	\$ 10,000	\$ 10,000	\$ 10,000
Local Technical Assistance:	\$ 15,000	\$ 15,000	\$ 15,000
NRCS Administration:	\$ 50,000	\$ 50,000	\$ 50,000
NRCS Technical Assistance:	\$ 92,000	\$ 92,000	\$ 92,000
Total Estimated Cost:	\$1,156,000	\$1,806,000	\$2,291,000
Grand Total Project Cost:	\$5,260,000	\$6,437,000	\$6,921,000

The following table provides a summary description of the main alternative components and the associated damages, number of properties impacted, economic costs, benefits, net economic benefits and the estimated benefit/cost ratios.

Table J - Buena Vista Project Analysis Summary

Subwatershed	Future with Project Alternative 1	Future with Project Alternative 2	Future with Project Alternative 3
Subwatershed Specific Project Actions			
Chalk Mine Run	1855 feet channel improvement, replace Rockbridge Ave bridge, replace lumber plant bridge, raise berm, create stormwater basin, 1 debris basin	Same as Alternative 1 plus 825 feet channel improvement	Same as Alt. 2
Indian Gap Run	Replace railroad bridges with culvert, floodwall above Cedar, 1 debris basin	Same as Alternative 1 plus 1150 feet channel improvement, replace Magnolia Ave. culvert	Same as Alt. 2
Noel's Run	3 debris basins	Same as Alt. 1	Same as Alt. 1
Pedlar Gap Run	Replace railroad culvert, remove 1 bridge, 733 feet channel improvement, install 2 debris basins & 1 drop structure, replace 1 culvert with a bridge, realign 120 feet of channel	Same as Alternative 1 plus improve 1 culvert, replace 1 culvert w/ a high span bridge, install a floodwall above Magnolia Ave, install 900 feet of channel improvement	Same as Alt. 1 plus replace 2 culverts w/ high span bridges, replace Magnolia Ave. bridge, install 900 feet of channel improvement
Total Cost	\$5,260,000	\$6,437,000	\$6,921,000
Local Operation and Maintenance	\$21,000/Year	\$26,000/Year	\$28,000/Year
Local Administration & Technical Assistance	\$20,000/Yr. for 5 yrs.	\$20,000/Yr. for 5 yrs.	\$20,000/Yr. for 5 yrs.
Property Rights (based on \$27,500/ac)	\$292,500 Approx. 10.6 Acres	\$422,000 Approx. 15.3 Acres	\$419,000 Approx. 15.2 Acres
Utility & Road Relocation	\$47,000	\$97,000	\$97,000
Average Annual Equivalent Benefits	\$502,000	\$666,000	\$684,000
Average Annual Equivalent Costs	\$343,000	\$419,000	\$451,000
Net Benefits (Present Value)	\$2,188,000	\$3,386,000	\$3,199,000

Table J - Buena Vista Project Analysis Summary (cont.)

Subwatershed	Future with Project Alternative 1	Future with Project Alternative 2	Future with Project Alternative 3
No. Properties Damaged FWOP	No. Properties Damaged Alt. 1	No. Properties Damaged Alt. 2	No. Properties Damaged Alt. 3
5YR 39	5YR 33	5YR 4	5YR 4
25YR 277	25YR 138	25YR 96	25YR 90
100YR 341	100YR 258	100YR 230	100YR 210
Expected Damages FWOP	Expected Damages Alt. 1	Expected Damages Alt. 2	Expected Damages Alt. 3
5YR \$480K	5YR \$350K	5YR \$60K	5YR \$60K
25YR \$7.40M	25YR \$2.00M	25YR \$1.40M	25YR \$1.38M
100YR \$11.40M	100YR \$6.60M	100YR \$6.60M	100YR \$6.30M

Comparison of Alternative Plans

The following table summarizes each alternative considered. Major items included in the decision process are included.

Table K - Comparison of Candidate Plans

Project Investment	Alternative 1	Alternative 2 (NED Plan)	Alternative 3 (Recommended Plan)	Alternative 4 (No Action)
Channel Improvement	1,855 feet on Chalk Mine Run, 613 feet on Pedlar Gap Run & realignment of 120 feet on Pedlar Gap Run	Same as Alternative 1 plus 825 feet on Chalk Mine Run, 1,000 feet on Indian Gap Run, 150 feet on Noel's Run and 950 feet on Pedlar Gap Run.	Same as Alternative 1 plus 825 feet on Chalk Mine Run, 1,000 feet on Indian Gap Run, 150 feet on Noel's Run and 1095 feet on Pedlar Gap Run.	none
Bridge Replacement and/or Removal	Rockbridge Ave., Fitzgerald's Lumber Plant on Chalk Mine Run, both Norfolk Southern railroad bridges on Indian Gap Run, and lumber yard bridge on Pedlar Gap.	Same as Alt. 1 plus Magnolia Ave. on Indian Gap Run.	Same as Alt. 2 plus Magnolia Ave. at Pedlar Gap Run.	none
Culvert Replacement	Norfolk Southern RR and Linden Ave. at Pedlar Gap Run.	Same as Alt. 1 plus Woodland Ave. at Pedlar Gap Run.	Same as Alt. 2 plus 9th St. at Pedlar Gap Run	none

Table K - Comparison of Candidate Plans (cont.)

Items for Comparison	Alternative 1	Alternative 2 (NED Plan)	Alternative 3 (Recommended Plan)	Alternative 4 (No Action)
Floodwalls/Berms	Raise berm 2 feet on Chalk Mine Run	Same as Alt. 1 plus install a floodwall on Pedlar Gap Run	Same as Alt. 1	none
National Economic Development Account				
Adverse Annualized (AAEs)*	\$343,000	\$419,000	\$451,000	n/a
Beneficial Annualized (AAEs*)	\$502,000	\$666,000	\$684,000	n/a
Net Beneficial	\$159,000	\$247,000	\$233,000	n/a
Benefit/Cost Ratio	1.47	1.59	1.52	n/a
Environmental Quality Account				
Beneficial				
Water Quality	Reduced NPS pollution from sediment, oils, gas and sewage during flood events.	Same as Alt. 1.	Same as Alt. 1.	n/a
Riparian Area	Planted shrubs and trees will provide some limited wildlife habitat.	Same as Alt. 1.	Same as Alt. 1.	Existing scattered trees and shrubs provide limited wildlife habitat.
Adverse				
Water Quality	Temporary water quality impacts during project construction.	Same as Alt. 1.	Same as Alt. 1.	Water quality impacts from oils, sediment, gas and sewage in floods.
Riparian Area	Loss of a few scattered trees.	Same as Alt. 1.	Same as Alt. 1.	n/a
Other Social Effects Account				
No. of Properties Damaged by storm event:	5YR 33 25YR 138 100YR 258	5YR 4 25YR 96 100YR 230	5YR 4 25YR 90 100YR 210	5YR 39 25YR 277 100YR 341

* AAEs - Average Annual Equivalents based on 7.125% discount rate and a 55 year period of analysis.

Table K - Comparison of Candidate Plans (cont.)

Other Social Effects Account (cont.)				
Adverse				
n/a:	Debris basin at the end of 20th St. reduces size of ballfield parking area	Same as Alt. 1	Same as Alt. 1	Long term stagnation in economic activity and local job opportunities
Beneficial				
n/a	Provides flood protection for many low income, elderly and minority residents. Local economic development prospects improved.	Same as Alternative 1.	Same as Alternative 1.	none
Regional Economic Development Account				
Positive Effect				
	Alternative 1	Alternative 2 (NED Plan)	Alternative 3 (Recommended Plan)	Alternative 4 (No Action)
Annualized Benefits (AAEs*)				
Region:	\$502,000	\$666,000	\$684,000	n/a
Rest of Nation:	--	--	--	n/a
Negative Effect				
Annualized Costs (AAEs*)				
Region:	\$28,000	\$40,000	\$40,000	n/a
Rest of Nation:	\$315,000	\$379,000	\$411,000	n/a

* AAEs - Average Annual Equivalents based on 7.125% discount rate and a 55 year period of analysis.

Risk and Uncertainty

The estimates for flooding, costs and benefits are based upon the best data available at the time of the evaluation and development of the plan. Most of these data sources were derived from computer models related to hydrology, hydraulics and economics. Therefore, there is always a possibility of errors in measuring or estimating actual impacts. Variance between planned and actual costs and benefit estimates may also result.

Rational for Plan Selection

All three project alternatives have favorable benefit/cost (B/C) ratios and positive net economic benefits. The B/C ratios range from a low of 1.47 for Alternative 1, to 1.59 for Alternative 2. Alternative 3 has a B/C ratio of 1.52, which is in between the estimates for the other two alternatives. Each of the three project alternatives improves upon the Future Without Project alternative by both reducing the total number of properties and infrastructure items damaged, and by reducing the value of remaining damages which result because expected water depths will be lower with each one.

Alternative 2 is projected to yield the highest amount of net benefits, estimated at \$3,386,000 in present value terms. NRCS policy requires agency professionals to recommend to the project sponsors the alternative with highest net economic benefits. The alternative which maximizes net economic benefits is considered the one which achieves National Economic Development (NED). National policy requires the NRCS to select the NED alternative for implementation unless other considerations are judged sufficient to result in another alternative being preferred by the NRCS and local sponsors.

After consultation with the local sponsors, alternative 3 was selected as the recommended plan. Alternative 3 yields \$187,000 less in net benefits than the NED alternative (\$3,199,000), but provides a more complete treatment of the flooding problems. An additional 26 properties are protected with alternative 3 as compared to alternative 2. Alternative 3 also best meets the local acceptability criteria, i.e., it is the preferred alternative of the project sponsors and public because it includes specific considerations that better meet their needs and it provides more protection than the other alternatives. The projected average annual damages associated with alternative 3 are lower for any given storm event than for alternatives 1 and 2. However, the added costs associated with alternative 3 increased more relative to the added benefits which indicates that the point of diminishing returns for added investments has been surpassed.

CONSULTATION AND PUBLIC PARTICIPATION

Local, State and Federal support for the proposed Buena Vista Watershed Project has been overwhelming. Input and involvement of the public has been solicited throughout the planning of the project. Through meetings and correspondence with the local sponsors, public, other agencies and organizations, the members of the Natural Resources Planning Team have received input into the planning of this watershed.

In May 1993, following the flood of 1992, the Sponsors submitted an Application For Federal Assistance requesting that NRCS address the interior streams flooding problem.

In June 1994, a public meeting was held at the Buena Vista City Hall. The meeting was attended by approximately 30 people who were landowners and/or government agency representatives. The project was discussed with people voicing their issues and concerns about the watershed. Almost all in attendance were supportive of the project and were in favor of pursuing the development of a flood control plan for the Buena Vista Watershed.

The project was discussed at a scoping meeting held on February 28, 1995. The meeting was attended by NRCS, U.S. Forest Service, Virginia Department of Conservation and Recreation, City of Buena Vista, Army Corps of Engineers, Central Shenandoah Planning District Commission and local landowners. Forty other groups and individuals that were on a U.S. Forest Service scoping list were also contacted by letter.

A public meeting was held on October 24, 1996 at City Hall where the preliminary hydrology and hydraulics model results were presented and accepted by those in attendance.

Information was presented by NRCS at City Council meetings held on November 18, 1997 and December 18, 1997 on the various alternatives. City Council selected Alternative 3 as the recommended alternative at the December 18, 1997 meeting.

A public meeting was held on January 29, 1998, at City Hall to present Alternative 3, the recommended plan, to the public and get their comments before completing the Draft Plan. The meeting was attended by about 25 people. The plan received favorable support from those in attendance.

A Draft Plan and Environmental Assessment was distributed for interagency and public review and comments on April 1, 1998. The notice of the Draft Plan/EA was published in the Federal Register. The comment period ended on May 18, 1998. Due to the final cost estimates exceeding \$5 million dollars, and NRCS statute which require plans that exceed \$5 million to be evaluated as an EIS and also to go to Congress for approval. Therefore, NRCS determined that an EIS was needed based on these requirements.

A scoping meeting was held on the intent to prepare an EIS in Lexington on September 3, 1998. The meeting notice was published in the Federal Register and local newspapers and a Notice to Prepare an EIS was sent to interested agencies, organizations and individuals. NRCS was the only agency that attended the meeting. No additional comments were received from others.

A Draft Plan-EIS was distributed for interagency and public review on October 13, 1998. The EIS Notice of Availability was published in the Federal Register, Volume 63, Number 210 on October 30, 1998. The official comment period ended on December 14, 1998.

Comments were requested on the Draft Plan and EA from the following agencies and organizations and they have responded as follows:

<u>Federal Agencies</u>	<u>Draft Plan/EA</u>	<u>Draft Plan/EIS</u>
Environmental Protection Agency		
Office of Federal Activities	No Response	No Response
Region III, Philadelphia	No Response	Responded
U.S. Army Corps of Engineers, Norfolk District	Responded	Responded
U.S. Department of Agriculture		
Forest Service	Responded	No Response
Farm Services Agency	No Response	No Response
Rural Development	Responded	No Response
U.S. Department of Commerce	No Response	Responded
U.S. Department of Energy	No Response	No Response
U.S. Department of Housing and Urban Development	No Response	No Response

<u>Federal Agencies</u>	<u>Draft Plan/EA</u>	<u>Draft Plan/EIS</u>
U.S. Department of Transportation	No Response	No Response
U.S. Department of the Interior		
Secretary of the Interior	No Response	Responded
Office of Environmental Policy and Compliance	Responded	No Response
Fish and Wildlife Service		
Annapolis, Maryland Office	No Response	No Response
White Marsh, Virginia Office	No Response	No Response
Office of Advocacy and Enterprise	No Response	No Response
Federal Emergency Management Agency, Philadelphia	No Response	No Response
<u>Virginia State Agencies</u>		
Virginia Department of Environmental Quality	Responded	Responded
Office of Environmental Impact Review (State Clearinghouse)		
Virginia Soil and Water Conservation Board (Governor's Designated Agency)	No Response	No Response
Virginia Department of Emergency Services	No Response	No Response
Virginia Department of Agriculture and Consumer Services	Responded	Responded
Virginia Department of Conservation and Recreation,	Responded	Responded
Virginia Department of Game and Inland Fisheries	No Response	No Response
Virginia Marine Resources Commission	Responded	Responded
Virginia Department of Historic Resources	Responded	Responded
Virginia Department of Transportation	Responded	No Response
<u>Other</u>		
Virginia Association of Soil and Water Conservation Districts	No Response	No Response
Natural Bridge Soil and Water Conservation District	Responded	Responded
Buena Vista City	Responded	Responded
Rockbridge County Board of Supervisors	No Response	No Response

<u>Other</u>	<u>Draft Plan/EA</u>	<u>Draft Plan/EIS</u>
Central Shenandoah Planning District Commission	Responded	No Response
National Resources Defense Council, Inc.	No Response	No Response
National Wildlife Federation	No Response	No Response
Sierra Club	No Response	No Response
National Audubon Society	No Response	No Response

CIVIL RIGHTS AND ENVIRONMENTAL JUSTICE IMPACT ANALYSIS

The median housing value in Buena Vista is \$42,900, while the state average is \$90,400. Buena Vista's median housing value represents 47% of the Virginia value. The average home value in Chalk Mine Run is only \$31,447, or 35% of the state-wide median value. The average value of homes in Reservoir Hollow is \$32,773, or 36% of the VA value. Average values in Pedlar Gap Run and Indian Gap Run are \$39,874 (44% of the VA value) and \$47,237 (52% of the VA value) respectively.

The Buena Vista Storm Drainage/Flood Control Survey found that 337 persons (178 households), or 66.2% of those interviewed, had incomes below the low-to-moderate income limits as defined by the latest HUD Section 8 income guidelines for the City. Average household income for Buena Vista residents in 1989 was \$26,827, while per capita income (PCI) was only \$10,241. PCI for the U.S. during the same year was \$17,596, making Buena Vista's PCI only 58% of the national per capita income level. Fourteen percent (870) of Buena Vista total population lived below the poverty level in 1989, as compared to 10 percent for all of Virginia. Fifteen percent of the households (371) in Buena Vista have residents who lived below the poverty line in 1989, while 10.5 percent of the state's households were below the poverty level in 1989. Virginia's average household income for 1996 was \$41,470, while per capita income was estimated at \$15,688 in 1993.

Median property values as noted above are far lower than 75% of state or national property values and median per capita income is lower than 75% of state and national average per capita incomes. Consequently, Buena Vista meets the criteria of a disadvantaged community according to the NRCS National Watershed Manual. The majority of the community's economically disadvantaged residents are white (95% or 6,093 out of a total population of 6,406). However, 4.9% (313 total) of Buena Vista's population are minorities (282 blacks), as compared to the 3.7% which are minorities in Rockbridge County and 23% in Virginia and 20% in the U.S. as a whole. Buena Vista's minority population is not concentrated in any single area of the City.

In addition to the income and property value criteria used for determining community status, the age distribution of Buena Vista's population indicates that 1,367 (21%) are over 60 years old as compared to 15% for the state as a whole. Finally, Buena Vista has had a depressed economy due to flooding which has driven the population down 7.2% over the 1980 to 1990 time frame and has caused over 48% of the workforce to seek employment outside of the City.

All of the evaluated and proposed project actions will have a positive economic and social effect across all race and ethnic groups in Buena Vista. No race or ethnic groups will be disparately treated as a result of proposed project actions. This is being assured because NRCS policy and the sponsors explicitly wanted to avoid disparate treatment. For example, uneconomical treatment increments within subwatersheds which would not pay for themselves if forced to stand alone as separate projects, were included in the overall B/C analysis on a City watershed-wide scale. Such was the case for the Chalk Mine Run subwatershed. As a result of this consideration the poorest sections of the City will not be excluded from project improvements.

RECOMMENDED PLAN

Purpose and Summary

The primary purpose of this watershed plan is flood prevention. The following section of the watershed plan describes the types and quantities of planned structural measures, permits required, landrights, project costs, project installation and financing, responsibilities of NRCS and the Sponsors, risks and uncertainty, conditions for providing assistance, and operation, maintenance, and replacement agreements. The plan will be installed over a 5 year period and have an expected life span of 50 years.

Measures to be Installed by Subwatershed

The specific plan elements are outlined below by subwatershed. Refer to the project map for an overall perspective for the entire watershed.

Chalk Mine Run

- Increase channel capacity for 1190 feet immediately above Norfolk Southern bridge (305 feet of riprap, 885 feet of earth channel).
- Replace Rockbridge Avenue culvert with a bridge.
- Increase channel capacity for 350 linear feet going downstream on main channel behind shopping center from the confluence of Washer Hollow and Chalk Mine (earth channel).
- Increase channel capacity on Washer Hollow upstream of confluence with Chalk Mine Run for 315 feet (140 feet of earth channel, 175 feet of riprap).
- Increase storage capacity of channel for larger storm events by excavating material from existing basin area above lumber plant bridge.
- Replace lumber plant bridge with a larger structure.
- Raise existing berm behind hotel.
- Construct a debris basin below the Catalpa Street bridge.
- Increase channel capacity below Norfolk Southern bridge for a distance of 825 feet (545 feet of riprap channel and 280 feet of earth channel).

Indian Gap Run

- Replace the two railroad bridges with five 10'x10' box culverts, 130 feet long.
- Install a debris basin near the ballfield at the end of 21st Street.
- Install a 3' high concrete floodwall along the channel at Hawthorne Avenue (500 feet).
- When the new bridge is installed at Cedar Avenue, grade the road so that flow that escapes the channel will be directed back in before it reaches Twentieth Street. (To be done by the City).
- Add approximately 300 feet of channel improvements below Magnolia Avenue and 700 feet of channel improvements above Magnolia Avenue. (To be done by VDOT).
- Replace the Magnolia Avenue bridge with 4 8'x6' box culverts. Approximately 150 FEET of Noel's Run will be improved to match the new grade on Indian Gap Run.

Noel's Run

- Install 3 debris basins.

Pedlar Gap Run

- Replace the railroad culvert with two 10'x10' box culverts and lower the invert elevation by 5 feet. Approximately 120 feet of channel would be realigned.
- Remove the Linden Avenue culvert and replace it with a hy-span type bridge deck.
- Remove the abandoned lumber yard bridge.
- Install one debris basin above 2nd Street and another one above 5th Street.
- Replace the Magnolia Avenue bridge with three 10'x 8' box culverts.
- Remove the 9th Street culvert and replace the culvert with a hy-span type bridge.
- Remove the Woodland Avenue culvert and replace it with a hy-span type bridge.
- Improve the channel from the railroad to a point approximately 250 feet above Woodland Avenue (1708 feet, includes 120 feet of channel alignment).

Effects of the Recommended Plan

Economic Effects

The economic evaluation of all damage categories indicates that the recommended alternative will result in a 61 percent reduction in projected average annual damages. The \$1,396,000 in average annual damages estimated for the without project alternative represents about 6.9 percent of the total value of buildings and contents receiving damages. Average annual damages would be reduced to \$549,000 or less than 2.7 percent of the estimated total value. Storms comparable to the back to back June floods of 1995 account for a large proportion of total projected future damages. The following summary and comparison of the recommended alternative with the future without project alternative shows that a majority of damages and damage reduction benefits occur within the Indian Gap Run subwatershed.

Table L - Buildings Flooded By Storm Event

Storm Event	Without Project	Recommended Plan	Recommended Plan, Indian Gap Run Only
100 Year	341	210	161
25 Year	277	90	56
5 Year	39	4	2

As indicated above, future flood damages and threats to loss of life would be substantially reduced with the recommended alternative. However, they can not be eliminated entirely. Damaged properties remaining from the 100 year storm event as a result of the recommended alternative include 161 within Indian Gap Run, 23 within Chalk Mine Run, 16 within Noel's Run and 10 within Pedlar Gap Run (210 total properties receiving damages). Thus the recommended alternative protects 130 properties from the 100 year storm event. In addition, 185 properties are afforded protection from 25 year storm events and 35 properties are protected from the more frequent 5 year storm events. It is also noteworthy that this

effort, combined with the Army Corps of Engineers Maury River project, will enhance local economic development opportunities.

Social Effects

The proposed alternative will not have any foreseen long-term or significant negative social effects which the community can not accept. The installation of a debris basin in the headwaters of Indian Gap Run near the public ballpark at the end of 20th Street will negatively affect recreation, but is not anticipated to cause a major impact. The installation of this structure will occupy a portion of the existing parking lot which serves the ballpark. In addition, an additional 6 debris basins and numerous other works of improvement (floodwalls, berms, channel work, etc.) will cause changes to the way the intercity streams look. Efforts will be made to minimize any negative views from these structures by including landscape architecture input into the designs and landscaping around these features.

Perhaps the most important negative social effect of the project will be the procurement of an estimated 15.2 acres of landrights needed to install project measures. This cost category (\$419,000) is the responsibility of the sponsors and is expected to be the largest cost component that the community has to pay. In addition, there will be temporary disruptions to local transportation and potable water and sewer services during construction of elements of the proposed project. However, the long-term benefits of reduced damages and decreased threats of loss of life will far exceed any expected inconveniences.

Buena Vista meets the criteria of a disadvantaged community according to the NRCS National Watershed Manual. Median property values are lower than 75% of state property values and per capita income for Buena Vista over the last three years is less than 75% of national per capita income, and the benefit/cost ratio of the Recommended Plan is greater than the ratio of the per capita income for Buena Vista divided by the national 3-year average per capita income.

Forestry Resources

All proposed project activities are planned for installation outside of the George Washington and Jefferson National Forests. The project area is outside of, and downslope from, heavily forested areas. Thus, there will be no effects on forestry resources.

Water Quality

A reduction in floodwaters will result in decreased sediment loading and less oils, gases and sewage being washed into the streams. Water quality will be improved in the watershed as a result of the implementation of this project.

There will be temporary water quality impacts during the construction phase of the project. Sediment and erosion control regulations will be followed during construction activities.

Flooding

Economic damages from flooding will be reduced 88% for the typical 5 year storm, 81% for the 25 year storm, and 45% for the 100 year storm event. The number of properties affected by flooding will be reduced from 39 to 4 structures (90%) in a typical 5 year storm, from 277 to 90 structures (68%) in a 25 year storm, and from 341 to 210 structures (38%) in a 100 year storm event.

Cultural Resources

The Virginia Department of Historic Resources (DHR) was consulted in accordance with Section 106 of the National Historic Preservation Act (NHPA). Their cultural resources review of this project indicated that there are no archaeological sites within the construction limits of the project. However, DHR has asked for additional information on the four railroad bridges and one small road bridge which will be impacted by the proposed project. The requested information will be provided by NRCS for DHR's review and concurrence prior to construction. Should cultural resources be discovered during construction, NRCS will take necessary actions according to policy and in compliance with the NHPA.

Wetlands

There are no wetlands within the construction limits of this project and this project will not affect wetlands outside the project area. This project will not create or restore wetlands. Therefore, there will be no effects on wetlands when this plan is completed.

Threatened, Endangered and Rare Species

No threatened or endangered species exist in the project area. There will be no effect on threatened and endangered species due to this project.

Aquatic Resources

These warm water intermittent streams are typical of highly modified, unstable, and disturbed urban streams. The planned 5,538 feet of channel improvements, 7 debris basins and the replacement, enlargement or removal of 7 culverts and bridges will result in a stable stream with low flow channels. Sediment delivery will increase during the construction period. However, this can be minimized if the stream channel modifications are performed during low flow or no flow periods. Debris basins will remove bedload and sediment, improving water quality. Bank erosion will be reduced which will allow the individual landowners and/or project sponsors to establish riparian vegetation. This will provide shade and temperature regulation for the stream. Fish movement in the four streams in the project area is generally limited to periods of high flow and storm events. The fish movement is downstream with high flows. There is very little chance of fish movement upstream at any time due to the intermittent stream conditions. Fish species and benthic organisms are not expected to change. This project will improve the stability of the stream, fisheries habitat, benthic organisms and the riparian area of these streams.

Wildlife

Since this is an urban setting, no significant changes are expected regarding wildlife populations or diversity as a result of the proposed project. However, more stable riparian areas which result in permanent vegetation, will improve habitat for small mammals, resident and migratory birds within the City limits.

Table M - Effects of the Recommended Plan on Resources of Principal National Recognition

Types of Resources	Principal Sources of National Recognition	Measurement of Effects
Air Quality	Clean Air Act, as amended (42 U.S.C. 1857h-7 et seq.)	No change.
Areas of particular concern within the coastal zone	Coastal Zone Management Act of 1972, as amended, (16 U.S.C. 1451, et seq.)	The project area is not located in a coastal zone.
Endangered and Threatened Critical Habitat	Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)	No threatened and endangered species are present in the project area.
Upland and Wildlife Habitat	Fish and Wildlife Coordination Act (16 U.S.C. Sec. 661 et seq.)	More stable riparian areas resulting in permanent vegetation will improve habitat of aquatic resources, small mammals, resident and migratory birds within the City.
Floodplains	Executive Order 11988, Floodplain Management	Reduce bedload deposition.
Historic and Cultural Properties	National Historic Preservation Act of 1966, as amended, (16 U.S.C. Sec. 470, et seq.)	No known historic resources are to be affected.
Prime and Unique Farmland	CEQ Memorandum of August 1, 1980: Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act. Farmland Protection Policy Act of 1981, (7 U.S.C. 4201 et seq.)	None present in the project area.
Water Quality	Clean Water Act of 1977 (33 U.S.C. 1251 et seq.)	Reduced overland flow will result in less contaminants to receiving waters. Sediment carried in storm flows will be reduced.

Table M - Effects of the Recommended Plan on Resources of Principal National Recognition (Con't)

Types of Resources	Principal Sources of National Recognition	Measurement of Effects
Wetlands	Executive Order 11990, Protection of Wetlands; Clean Water Act of 1977 (42 U.S.C. 1857H-7, et seq.)	There are no wetlands identified in the project area. No effect.
Wild and Scenic	Wild and Scenic Rivers Act, as amended, (16 U.S.C. 1271 et seq.)	There are no designated Wild and Scenic Rivers in the project area. No effect.
Economic	NA	Reduced flooding and flood related damages are predicted as a result of this project.
Fisheries	Fish and Wildlife Coordination Act (16 U.S.C. Sec. 661 et seq.)	The fisheries may be adversely impacted during construction. However, long term beneficial effects are expected due to more stable streambanks and vegetation.
Forestry	NA	There will be no forest impacts.
Recreation	NA	This project will have no effect on recreation.
Riparian Zone	NA	Riparian vegetation that is destroyed will be replaced where possible.

Conditions for Providing Assistance

Federal assistance for carrying out this plan will be provided under the authority of PL 83-566. However, it should be noted that this is not a fund obligating document. Financial and other assistance to be furnished by the NRCS in carrying out the plan is contingent upon the availability of federal appropriations and the Sponsors obtaining the necessary landrights and permits.

Project Interaction

This watershed plan was developed to address primarily the interior stream flooding problems in Buena Vista. The plan serves to complement the flood wall constructed by the U. S. Army Corps of Engineers. It further complements additional efforts currently underway by the City to install a concrete lined channel on Indian Gap Run, bridge and culvert improvements throughout the four subwatersheds, and the City, FEMA, Virginia Department of Emergency Services and the Central Shenandoah Regional Planning District Commission plans to buyout, relocate and or floodproof selected repetitive loss structures.

The NRCS will assist the project sponsors with both technical and financial assistance in the installation of the planned works of improvement. Coordination will be required between the City, Norfolk Southern Railroad, Virginia Department of Transportation, and others in order to make the project a reality.

It is expected that many agencies and organizations will be complementary participants in this much needed watershed plan as demonstrated by the widespread input and support during the planning process.

Landrights

An area of approximately 15.2 acres will be required for installation of various works of improvement. This area will be acquired by the local Sponsors.

Permits and Compliance

No adverse effects on wetlands or floodplains are anticipated. However, it is the responsibility of the local sponsors to obtain the necessary environmental permits for the installation of the planned works of improvement. A joint permit application will be necessary and can be filed by applying to the Virginia Marine Resources Commission, the Virginia Department of Environmental Quality and the U.S. Army Corps of Engineers. NRCS will assist the sponsors with the permit application process.

The sponsors are responsible for compliance with the permit conditions once the permits have been obtained.

Costs

As indicated in Table 1, the total project installation cost of the recommended plan is \$6,921,000. Of this amount, PL-566 funds will bear \$6,305,000 and local funds will bear \$616,000. Table 2 shows the cost of structural measures, by category. Construction costs are paid by PL-566 funds and total \$5,420,000. This includes all costs of material, labor, and equipment. Engineering costs include all costs for designs (including some architectural and engineering consulting services), construction surveys, geologic and soils investigations, and development of contract drawings and specifications. The total engineering costs, estimated at \$740,000, will be paid by PL-566 funds, except for any inspection cost incurred by the sponsors.

Project administration costs are estimated to be \$185,000 and will be paid by NRCS (\$145,000) and the sponsors (\$40,000). NRCS will incur project administration costs through the administration of contracts to install the structural measures and providing government representatives and inspection services during construction to insure that the measures are installed according to plans and specifications. The Sponsors' project administration costs will be associated with the administration of contracts, purchase of property rights, and utility and road relocations.

Landrights costs are estimated at \$419,000 and will be paid by the City of Buena Vista. Some of the property is already owned by the City. Utility and road relocation costs total \$97,000 and will be paid by the City of Buena Vista.

The above planning costs for the structural measures are estimated costs only. The fact that these costs are included in this plan does not infer that they are final costs. Detailed structural designs and construction cost estimates will be prepared by NRCS or Architectural and Engineering firms prior to contracting for the work to be performed. Final construction costs will be those costs actually incurred by the contractor performing the work, including the cost of any necessary contract modifications. Final landrights costs will be those costs actually incurred by Buena Vista in obtaining the necessary landrights for the project.

Table 4 shows the average annual costs of installation and the estimated cost of annual operation, maintenance, and replacement. The 1998 price base cost estimates were brought to present value and amortized at 7.125% interest for the 55-year period (installation 5 years and evaluation 50 years). The operation, maintenance, and replacement costs are a local cost amounting to \$28,000 annually.

Table 5 displays average annual flood damage reduction benefits by flood damage categories, and Table 6 displays a comparison of annual costs and benefits.

Installation and Financing

The NRCS will provide technical assistance to the Sponsors for designing and constructing planned project measures. NRCS will also provide funds for cost sharing and will administer the overall project, except for obtaining any necessary landrights and permits, or for performing certain contract administrative functions which the Sponsors may conduct. The City of Buena Vista and the Natural Bridge Soil and Water Conservation District will provide sponsorship, specify objectives and concerns, provide inputs, help with plan implementation, and inform the public of the watershed plan activities.

Table N - Schedule of Obligations

Year	Item	PL-566	Other	Total
1999	Construction Costs	\$1,084,000	\$0	\$1,084,000
	Property Rights	\$0	\$84,000	\$84,000
	Utility Relocations	\$0	\$24,000	\$24,000
	Technical Assistance	\$148,000	\$12,000	\$160,000
	Project Administration	\$29,000	\$8,000	\$37,000
2000	Construction Costs	\$1,084,000	\$0	\$1,084,000
	Property Rights	\$0	\$84,000	\$84,000
	Utility Relocations	\$0	\$18,000	\$18,000
	Technical Assistance	\$148,000	\$12,000	\$160,000
	Project Administration	\$29,000	\$8,000	\$37,000
2001	Construction Costs	\$1,084,000	\$0	\$1,084,000
	Property Rights	\$0	\$84,000	\$84,000
	Utility Relocations	\$0	\$18,000	\$18,000
	Technical Assistance	\$148,000	\$12,000	\$160,000
	Project Administration	\$29,000	\$8,000	\$37,000
2002	Construction Costs	\$1,084,000	\$0	\$1,084,000
	Property Rights	\$0	\$84,000	\$84,000
	Utility Relocations	\$0	\$18,000	\$18,000
	Technical Assistance	\$148,000	\$12,000	\$160,000
	Project Administration	\$29,000	\$8,000	\$37,000
2003	Construction Costs	\$1,084,000	\$0	\$1,084,000
	Property Rights	\$0	\$84,000	\$84,000
	Utility Relocations	\$0	\$18,000	\$18,000
	Technical Assistance	\$148,000	\$12,000	\$160,000
	Project Administration	\$29,000	\$8,000	\$37,000
Total Project Cost	----	\$6,305,000	\$616,000	\$6,921,000

February 1998 Price Base

Technical assistance includes design and construction supervision. Utility relocations includes relocation of a small section of 20th St. near the ballfield.

Operation, Maintenance, and Replacement

An operation and maintenance agreement and plan will be developed by the sponsors based on the National Operation and Maintenance Manual of the NRCS before signing landrights, relocation or project agreements. To meet Virginia requirements, an Emergency Action Plan will be developed also. Operation, maintenance (O&M) and replacement of structural measures will be the responsibility of the Sponsors, with technical assistance from the NRCS.

Operation, maintenance and replacement costs include all costs for inspections of the measures, periodic maintenance required to ensure that the measures function over the evaluation period (5 years of installation and 50 years estimated useful life for project structures), and replacement costs necessary to replace project features that become worn or broken during the project evaluation period. The estimated

annual O&M cost represents an average value over the 55 year evaluation period. Initially, the annual O&M costs may be lower than the estimate but will gradually increase as project installations become older. Some of the more obvious operation, maintenance and replacement items are:

- Conduct annual inspections of project structures to determine needed maintenance and repair items.
- Conduct inspections of all structures, especially debris basins and channel improvements, after each major storm event to determine if damage occurred and the maintenance and repair requirements.
- Keep a record of all inspections and their findings, maintenance items performed and costs expended.
- Remove debris from the structures and channels on a regular (annual) basis, and after each major storm event.
- Replace any broken features of project improvements, especially fences, grates, access gates, etc.

The City of Buena Vista will be responsible for maintaining all project structures and channel improvements. The estimated annual cost of this work is \$28,000. The City expects to perform this work using its own work force, equipment and other resources.

An establishment period will be required for all structural works of improvement which necessitate vegetative cover and/or landscape features. The establishment period applies to both vegetation installed as a structural measure or in association with structural practices. The establishment period terminates when the NRCS notifies the Sponsors that vegetative cover has been successfully established, but not longer than two years following completion of the construction and/or vegetative contracts. Work needed on vegetative measures after termination of the establishment period is considered as maintenance and is the responsibility of the Sponsors.

References

- The Donnelly Report. Report Data for Virginia Counties, Cities, and Towns: Summary of 1991. Biennial Report. October 8, 1992.
- Virginia Employment Commission, Economic Information Services Division, Virginia Population Projections, 2010, June 1993.
- Virginia Statistical Abstract 1992-1993 and 1996-1997 Editions, Center for Public Service, University of Virginia.
- Buena Vista, VA Local Flood Protection Study. US Army Corps of Engineers, Norfolk District. Rev. June 1990.
- Economics Overview 1998, Rockbridge County and the Cities of Buena Vista and Lexington, Central Shenandoah Planning District Commission, April 1998.
- Federal Emergency Management Agency, Federal Insurance Administration Data, July 14, 1993.
- U.S. Travel Data Center. "Travel in Virginia in 1988: An Economic Analysis". Washington, DC.
- 1989 Virginia Outdoors Plan, Commonwealth of Virginia, Department of Conservation and Recreation, Division of Planning and Recreation Resources. June 1989.
- Douglas, J. E., and W. T. Swank. Streamflow Modification Through Management of Eastern Forests. USDA Forest Service Research Paper SE-94. 1972.
- Rosgen, Dave. Applied River Morphology. Wildland Hydrology. 1996.
- Chow, Ven Te. Open-Channel Hydraulics. McGraw-Hill Book Company. 1988.
- Weather Bureau. Technical Paper No. 40.
- U.S. Army Corps of Engineers. HEC-1 Flood Hydrograph Package. September 1990.
- U.S. Army Corps of Engineers. HEC-2 Water Surface Profiles. May 1991.
- U.S. Department of Commerce, Bureau of Economic Analysis, 1998.
- USDA Natural Resources Conservation Service. Technical Release No. 55, Urban Hydrology for Small Watersheds. June 1986.

LIST OF PREPARERS

The Draft Watershed Plan and Environmental Impact Statement was reviewed and concurred in by state staff specialists having responsibility for engineering, resource conservation, soils, agronomy, biology, economics, and geology. A similar review was also provided by the U.S. Forest Service personnel. This review was followed by an interagency and public review.

Table O - List Of Report Preparers

VIRGINIA NATURAL RESOURCES PLANNING TEAM

<u>Name</u>	<u>Present Title and Years in Current Position</u>	<u>Education</u>	<u>Previous Experience</u>	<u>Other</u>
R. Wade Biddix	Planning Coordinator - 8	B.S. Agriculture	Area Res. Cons. - 2 yr. District Conservationist - 4 yr. Soil Conservationist - 4 yr.	
David L. Faulkner	Resource Economist - 9	M.S. Ag. Economics B.S. Ag. Economics	NRCS Ag Economist - 2.5 yr. Ag Economist (AID) - 4.5 yr.	
Roger F. Flint	Natural Resource Cons. - 17 yr.	B.S. Forest Resource Mgt.	Soil Conservationist - 5 yr.	
Brian W. Ganoe	Geologist - 7 yr.	B.S. Geology	NRCS Geologist - 13 yr. Geologist (Bureau Rec.) - 2 yr.	CPG in VA and IA
Fred M. Garst	GIS Specialist - 6 yr.	B.S. Geology	GIS/Soil Scientist - 7 yr. Soil Cons. Tech. - 7 yr. Geologist (Private) - 4 yr.	
Alica J. Ketchem	Plng./Environmental Engineer - 4	M.S. Ag. Engineering B.S. Civil Engineering	Civil Engineer - 9	PE
Gregory H. Moser	Biologist - 12	M.S. Aquatic Ecology B.S. Wildlife Mgmt.	Water Res. Biologist - 8 yr. District Conservationist - 5 yr. Soil Conservationist - 4 yr.	

Table O - List Of Report Preparers ((cont.))

VIRGINIA NATURAL RESOURCES PLANNING TEAM

<u>Name</u>	<u>Present Title and Years in Current Position</u>	<u>Education</u>	<u>Previous Experience</u>	<u>Other</u>
John D. Myers	Environmental Specialist - 6	B.S. Wildlife Mgmt.	District Cons. - 12 yr. Soil Cons. - 2 yr. U.S. Fish & Wildlife Service - 2 yr.	

USDA, FOREST SERVICE

Dick Patton	Zone Hydrologist - 3	M.S. Forest Resources M.A.T. History B.A. History	Forest Hydrologist - 10 yr. District Hydrologist - 4 yr. Hydrologist Trainee - 1 yr.	
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Note: Glenn Sorensen, Hydraulic Engineer with Dewberry and Davis, developed the initial hydrology and hydraulics models used to evaluate the watershed.

Special Acknowledgment goes to the Engineering Survey Crew who spent many hours in Buena Vista during the spring and summer of 1995.

- NRCS Staff: Jerry D. Hughston, Project Engineer; Charles E. (Billy) Bear, Civil Engineering Technician; John M. Cooke, Construction Inspector; Mike Deacon, Natural Resource Technician; Alica J. Ketchem, Planning/Environmental Engineer; David L. Faulkner, Resource Economist; Roger F. Flint, Natural Resource Conservationist; and R. Wade Biddix, Planning Coordinator.
- Natural Bridge Soil and Water Conservation District Staff: Robert Hickman, District Technician
- Earth Team Volunteers: Rachel Kornfeld, Lee Cundiff and Trey Cooke

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Table 1 - Estimated Installation Cost

Buena Vista Watershed, Rockbridge County, Virginia

(Thousands Dollars)

Installation Cost Item	Units	Number			Public Law 83-566 Funds			Other Funds			Grand Total
		Federal Land	Nonfederal Land	Total	Nonfederal Land NRCS	FS	Total	Federal Land	Nonfederal Land	Total	
Bridges/ Culverts	Each	n/a	10	10	3,590	0	3,590	0	55	55	3,645
Channel Improve- ments	Miles	n/a	1.03	1.03	1,206	0	1,206	0	361	361	1,567
Debris Basins	No.	n/a	7	7	1,410	0	1,410	0	184	184	1,594
Flood- walls	Ft.	n/a	700	700	106	0	106	0	9	9	115
Total Project:	n/a	n/a	n/a	n/a	6,312	0	6,312	0	609	609	6,921

Price Base: 1998

Table 2 - Estimated Cost Distribution - Structural Measures

Buena Vista Watershed, Rockbridge County, Virginia

(Thousands Dollars)

Item	-----PL-566-----				-----Others-----					
	Construc- tion	Engineer- ing ¹	Project Admin.	Sub- Total	Property Rights	Project Admin.	Tech. Assist.	Utility Relocation ²	Sub- Total	Grand Total
Bridges/ Culverts	2,948	567	76	3,590	0	22	33	7	61	3,651
Channel Improve- ments	1,120	59	28	1,207	271	8	12	70	361	1,568
Debris Basins	1,256	108	39	1,403	141	10	14	20	185	1,589
Flood- walls	96	6	3	105	6	1	1	0	8	113
Totals:	5,420	740	145	6,305	419	40	60	97	616	6,921

Price Base: 1998

Note: Some subtotals may not add up due to rounding.

¹ Includes \$80,000 in NRCS technical assistance during design and \$225,000 in NRCS technical assistance costs during construction.

² Includes \$7,000 for road relocation on Indian Gap Run.

Table 3a - Structural Data - Floodwalls and Dikes

Buena Vista Watershed, Rockbridge County, Virginia

Dike	Stationing	Top width (ft.)	Average side slope	Average height of dike (ft.)	25-year frequency channel velocity (ft/s)	Dike protection	Volume of earth fill (yd ³)
Indian Gap	24 + 63 to 29 + 63	2	vertical	3	9.77	concrete	450
Washer Hollow (a tributary of Chalk Mine Run)	6 + 70 to 8 + 90	6	2:1	4 ¹	10.5	vegetation	330

¹ Existing berm will be made 2 feet higher.

Table 3b - Structural Data - Channel Work

Buena Vista Watershed, Rockbridge County, Virginia

Channel name (reach)	Station begin	Station end	Drain area (mi. ²)	Year freq.	Design discharge (ft ³ /s)	Water surface elev. feet (msl)	Hydraulic gradient (ft/ft)	Channel dimensions ¹				n Value (aged)	Velocity (ft/s) (aged)	Excavation volume ⁴ (yd ³)
								Gradient ² (ft/ft)	Bottom width (ft)	Elev. (ft/msl) ³	Side slope			
CMRc4	7+35	9+10	2.69	5	885	928.0	0.0297	0.0257	25	923.5	1.5:1	0.033	9.7	700
CMRc3	9+10	10+50 ⁵	2.69	5	885	922.8	0.0171	0.0129	25	919.0	2:1	0.05	7.5	610
CMRc2	16+20	20+30	5.39	5	1725	920.4	0.0183	0.0223	30	917.2	2.5:1	0.05	9.9	2830
CMRc1	20+30	23+30	5.85	5	1910	912.9	0.0123	0.0160	30	908.1	2:1	0.05	8.0	1480
CMRb4	50+40	55+50	5.85	25	5455	868.3	0.0190	0.0198	30	860.0	2:1	0.05	12.7	2070
CMRb3	55+50	57+60	5.85	25	5455	858.6	0.0167	0.0210	30	849.9	1.5:1	0.033	12.8	910
CMRb2	57+60	58+65	5.99	25	5562	855.1	0.0133	0.0050	35	845.5	1.5:1	0.033	9.7	660
CMRb1	58+65	62+40	5.99	5	2165	850.8	0.0148	0.0040	30	844.6	2:1	0.05	5.6	1770
CMRa2	62+60	65+40	5.99	5	2165	842.8	0.0125	0.0033	40	836.6	2:1	0.05	9.1	1850
CMRa1	65+40	70+85	5.99	5	2165	839.3	0.0120	0.0117	45	833.7	1.5:1	0.033	10	4380
IGR	55+69	64+11	3.87	5	1211	822.2	0.0024	0.0080	19	819.2	2:1	0.050	5	2650
IGR	65+26	68+26	4.44	5	1652	820.1	0.0023	0.0034	26	812.3	2:1	0.020	5	950
NR	59+70	61+20 ⁶	2.23	5	616	821.2	0.0011	0.0240	35	818.0	2:1	0.045	5.3	475
PGR 250 feet above Woodland to Magnolia	65+55	73+50	2.03	100	2607	861.1	0.0239	0.0271	10	852.5	2:1	0.033	11.0	2680
PGR 9th to Magnolia	73+50	76+50	2.03	100	2607	842.0	0.0353	0.0260	10	832.6	2:1	0.033	9.1	1030
PGR 9th to the railroad	76+50	83+83	2.03	100	2607	834.4	0.0148	0.0214	15	827.0	2:1	0.033	12.6	5659

¹ On Chalk Mine Run, cross-sections were modeled as trapezoids. For all other streams non-trapezoidal cross-sections with low flow channels were modeled.

² Average gradient for reach.

³ Upstream end of reach. Elevations are referenced to beginning of reach (u/s end).

⁴ Approximate quantities.

⁵ Washer Hollow station 10+50 is the same as Chalk Mine Run station 16+20.

⁶ Noel's Run station 61+20 is the same as Indian Gap Run station 61+29.

Table 3c - Structural Data - Debris Basins

Buena Vista Watershed, Rockbridge County, Virginia

Stream	Location	Approximate Station	Area
Chalk Mine Run	Catalpa Avenue	(CM 37+10)	1.50 acres
Indian Gap Run	end of 20th St. at the ballfield	(IG 15+48)	0.71 acres
Noel's Run	Pine Avenue	(NR 25+28)	0.90 acres
Noel's Run	Oak Avenue	(NR 38+00)	0.80 acres
Noel's Run	Maple Avenue	(NR 45+05)	0.20 acres
Pedlar Gap Run	end of 2nd Street	(PG 44+83)	1.10 acres
Pedlar Gap Run	Hazel Avenue at 5th St.	(PG 62+08)	0.40 acres

Table 3d - Structural Data - Bridges and Culverts

Buena Vista Watershed, Rockbridge County, Virginia

Stream	Crossing Location	Action	Structure
Chalk Mine Run	Rockbridge Avenue	replace culvert	160'x37' bridge with piers
Chalk Mine Run	Fitzgerald's lumber plant	replace bridge	65'x20' bridge with piers
Indian Gap Run	Norfolk Southern Railroad (2)	replace bridges	5 10'x10' box culverts, 130' long
Indian Gap Run	Magnolia Avenue	VDOT will replace bridge	4 8'x 6' box culverts, 67' long
Pedlar Gap Run	Norfolk Southern Railroad	replace culvert	2 10'x10' box culverts, 57' long
Pedlar Gap Run	Below Linden Ave.	remove bridge	none
Pedlar Gap Run	Linden Avenue	replace culvert	hy-span type bridge
Pedlar Gap Run	9th Street	replace culvert	hy-span type bridge
Pedlar Gap Run	Magnolia Ave.	replace bridge	3 10'x8' box culverts, 60' long
Pedlar Gap Run	Woodland Ave.	replace culvert	hy-span type bridge

Table 5 - Estimated Average Annual Flood Damage Reduction Benefits

Buena Vista Watershed, Rockbridge County, Virginia

(Dollars)

Flood Damage Category	Estimated Average Annual Damages		Damage Reduction Benefits	
	Without Project	With Project	Average Annual	Average Annual Equivalents
Structures	\$656,000	\$236,000	\$420,000	\$295,000
Contents	\$293,000	\$100,000	\$193,000	\$122,000
Private Clean-Up	\$39,000	\$22,000	\$17,000	\$28,000
Private Business Losses	\$140,000	\$93,000	\$47,000	\$116,000
Public Infrastructure	\$223,000	\$77,000	\$146,000	\$96,000
Public Administration	\$45,000	\$21,000	\$24,000	\$27,000
Grand Total	\$1,396,000	\$549,000	\$847,000	\$684,000

Price base: February 1998

Average Annual Equivalents based on 7.125% discount rate and a 55 year period of analysis.

Table 6 - Comparison of Benefits and Costs

Buena Vista Watershed, Rockbridge County, Virginia

(Dollars)

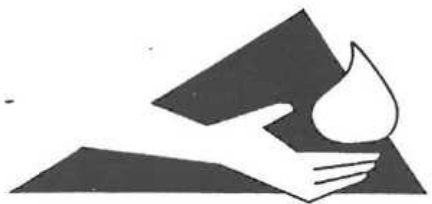
Item	Damage Reduction Benefits					Total Annual Costs	Benefit Cost Ratio
	Building Structures and Contents	Private and Public Clean-up and Public Infrastructure Repairs	Private Business Losses	Public Administration Costs	Total Annual Benefits		
All Public Works of Improvement	\$417,000	\$144,000	\$96,000	\$27,000	\$684,000	\$451,000	1.52

Price base: February 1998

Average Annual Equivalentents based on 7.125% discount rate and a 55 year period of analysis.

APPENDIX A

LETTERS OF COMMENT ON DRAFT PLAN-EIS



**NATURAL BRIDGE
SOIL AND WATER CONSERVATION DISTRICT
30 EAST PRESTON STREET
LEXINGTON, VA 24450
(540) 463-7125**

VIRGINIA SOIL & WATER
C O N S E R V A T I O N

Board of Directors

James A. Carter

Danny B. Goodbar

Jon Repair

Robert L. Simons, Jr. November 24, 1998

Phillip R. Welch

V. Stephanie Porras

J.R. "Jay" Gilliam

E. Burwell Wingfield

Ms. Denise Doetzer
State Conservationist
USDA Natural Resources Conservation Service
1606 Santa Rosa Road, Suite 209
Richmond, Virginia 23229-5014

Dear Ms. Doetzer:

The Natural Bridge Soil and Water Conservation District, which serves the city of Buena Vista, Virginia, would like to go on record in support of the efforts of the Natural Resources Conservation Service to reduce interior stream flooding in the city of Buena Vista. The comprehensive plan for the Buena Vista Watershed will help to alleviate a chronic flooding problem in the city. This is a situation that has caused millions of dollars in damage to homes, industry, businesses, and individual lives. Any means of minimizing this type of flooding will be helpful and very much appreciated.

With the "Buena Vista Watershed Plan" and "Environmental Impact Statement", we can prepare for the city's future in an organized and sound manner. This document provides us with a guide of practices and alternatives based on their benefit to cost. Never before has such a comprehensive study been done of the city.

Thank you and your staff for this effort. We look forward to the next phase in search of funding for this project.

Sincerely,

The Natural Bridge Soil and Water Conservation District Board of Directors

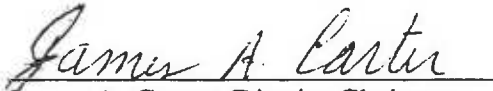
(Signature Page Attached)

cc: R. Wade Biddix
Program/Planning Leader

Signature Page to attached letter from the District:

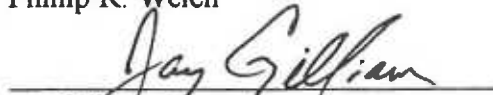
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30 East Preston Street
Lexington, Virginia 24450

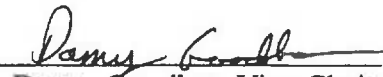
Serving the cities of Lexington, Buena Vista and Rockbridge County


James A. Carter, District Chairman


Jon Repair, Secretary

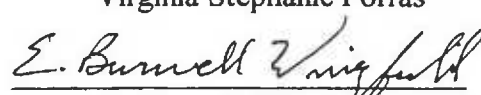
Phillip R. Welch


Jay Gilliam


Danny Goodbar, Vice-Chair


Robert L. Simons, Treasurer

Virginia Stephanie Porras


E. Burwell Wingfield

CITY OF BUENA VISTA

2039 Sycamore Avenue
Buena Vista, Virginia 24416-3112
Telephone (540) 261-8602
Fax (540) 261-2142

November 25, 1998

M. Denise Doetzer
State Conservationist
USDA - Natural Resources Conservation Service
Culpeper Building, Suite 209
1606 Santa Rosa Road
Richmond, Virginia 23229-5014

Dear Ms. Doetzer:

This is a follow-up to my May 12, 1998, letter which was written in support of the Buena Vista Watershed Plan developed by the Natural Resources Conservation Service (NRCS). As you are aware, the City has an extensive history of flooding from the Maury River and interior streams.

The U.S. Army Corps of Engineers has greatly reduced the potential for flood damages from the Maury with the completion of the James R. Olin Flood Protection Project. We have also undertaken various projects to reduce flooding along our interior streams. The cost to the City for these mitigation efforts is in excess of \$5,000,000 which is greater than our typical annual budget (general fund).

Having made such a great financial commitment, the City now needs assistance from the NRCS in our effort to further reduce the susceptibility to flooding from our interior streams. As you know, this is precisely the objective of the NRCS's Watershed Plan. The adoption of the Watershed Plan and implementation of the mitigation measures included therein would greatly benefit our citizens, including many low to moderate income households.

We appreciate the efforts of the NRCS and fully support the Plan. Please feel free to contact me if you should have any questions.

Sincerely,



Stephen G. King, P.E.

City Engineer/Assistant City Manager

CITY OF BUENA VISTA

City Hall

2039 Sycamore Avenue
Buena Vista, Virginia 24416

Telephone (540) 261-6121



November 25, 1998

M. Denise Doetzer, State Conservationist
USDA - Natural Resources Conservation Service
Culpeper Building, Suite 209
1606 Santa Rosa Road
Richmond, VA 23229-5014

Dear Ms. Doetzer:

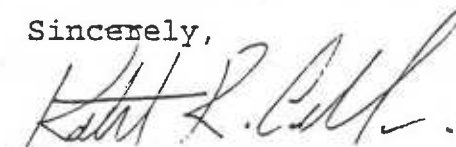
I am writing on behalf of the City of Buena Vista to express full support for the Buena Vista Watershed Plan. This plan was developed by the staff of the Natural Resources Conservation Service (NRCS). Public Hearings were conducted by the City Council for the City of Buena Vista and after review and consideration, the City Council fully endorsed the project.

The adoption of the Water Shed Plan would be very beneficial to the citizens of the City of Buena Vista. The assistance from the Natural Resources Conservation Service is urgently needed to reduce the potential for flooding from our interior streams.

The City appreciates very much the efforts of the NRCS staff and we fully support the Plan. The Plan would help us protect and maintain our natural resources.

If additional information is needed, please do not hesitate to contact me at 540-261-8600.

Sincerely,



Robert R. Collins
City Manager

City of Buena Vista

BUENA VISTA, VIRGINIA

OFFICE OF
THE MAYOR

TELEPHONE 261-6121
AREA CODE 703

November 25, 1998

M. Denise Doetzer, State Conservationist
USDA - Natural Resources Conservation Service
Culpeper Building, Suite 209
1606 Santa Rosa Road
Richmond, VA 23229-5014

Dear Ms. Doetzer:

I am writing on behalf of the City Council for the City of Buena Vista to express council's full support for the Buena Vista Watershed Plan. The Public Hearings have been conducted by the City Council and after review and consideration, the City Council fully endorses the project.

We feel the adoption of the Water Shed Plan would be very beneficial to the citizens of the City of Buena Vista. The Watershed Plan was developed by the Natural Resources Conservation Service and we feel is urgently needed to reduce the potential for flooding from our interior streams.

The Council for the City of Buena Vista appreciates the efforts of NRCS staff to develop this Plan. We feel the Plan is urgently needed to help us protect and maintain our natural resources.

If additional information is needed, please do not hesitate to let us know. I can be reached at 540-261-6315.

Sincerely,



Harold F. Kidd
Mayor



COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

Street address: 629 East Main Street, Richmond, Virginia 23219

Mailing address: P.O. Box 10009, Richmond, Virginia 23240

Fax (804) 698-4500 TDD (804) 698-4021

<http://www.deq.state.va.us>

Dennis H. Treacy
Director

(804) 698-4000
1-800-592-5482

December 11, 1998

M. Denise Doetzer
State Conservationist
USDA-National Resources Conservation Service
Culpeper Building, Suite 209
1606 Santa Rosa Road
Richmond, Virginia 23229-5014

RE: Draft Plan - Environmental Impact Statement for Buena Vista
Watershed in the City of Buena Vista and Rockbridge County

Dear Ms. Doetzer:

The Commonwealth of Virginia Agencies have completed their review of the draft plan - environmental impact statement for the considered action. The Department of Environmental Quality is responsible for coordinating Virginia's review of federal environmental documents and responding to the appropriate officials on behalf of the Commonwealth. The following locality and agencies participated in this review:

Department of Conservation and Recreation;
Department of Environmental Quality;
Department of Historic Resources;
Marine Resources Commission; and
City of Buena Vista.

The Central Shenandoah Planning District Commission was also invited to comment.

The action under consideration is a draft plan to reduce flood damages in the Buena Vista Watershed caused by Chalk Mine Run, Indian Gap Run, Noel's Run and Pedlar Gap Run. This plan was submitted for comment in April 1998 as an EA. Due to statute requirements, the plan has been revised as a draft EIS.

The Commonwealth asks that you continue to consider the comments submitted for the EA on May 18, 1998, on behalf of the

Ms. M. Denise Doetzer
December 11, 1998
Page Two

various state agencies, planning district, and locality. In addition, the Commonwealth offers the following comments and recommendations:

1. **Stream Impacts.** DEQ fully supports the replacement and upgrade of undersized culverts within the City to reduce the potential for flood damage. It is suggested that mitigation measures such as vegetative stabilization of eroding stream banks and associated buffer areas through easement, fee simple acquisition, or other means within and upstream of the City be included in the project as a means of managing debris and bedload transport to areas described in the EIS. Also, please verify that the railroad bridge over Chalk Mine Run, downstream of Route 60, has been evaluated for possible upgrade to ensure it has adequate capacity to allow design storms to pass. Please contact Tom Mizell at DEQ's Valley Regional Office at (540) 574-7800

In addition, where feasible the NRCS should implement Rosgen stream methodologies for stream channelization and/or relocation efforts. For further information, contact DEQ's Tracey Harmon at (804) 698-4105.

2. **Permitting.** Construction activities may result in the discharge of dredged or fill material to State waters requiring permitting by the U.S. Corps of Engineers and/or DEQ. For additional information on Virginia Water Protection Permit (VWPP) requirements, please contact DEQ's Valley Regional Office. Information contained in the EIS document is not adequate to allow an evaluation of potential project impacts to State waters at the level of detail required by the VWPP Regulation. Project proponents should be aware that a complete application for a VWPP must be made at least 180 days prior to the date planned for commencement of any permitted activity resulting in a discharge to State waters. A VWPP permit application must contain a discussion of measures taken to avoid impacts, measures proposed to reduce impacts to surface waters, and measures proposed to mitigate impacts to state waters where impacts are unavoidable.

Also, from the information provided in the EIS, it appears that several of the proposed projects will require a permit from Virginia's Marine Resources Commission (MRC). Joint Permit Applications are available through MRC and can be requested by calling (757) 247-2200.

3. **Erosion and Sediment Control.** If the project construction disturbs over 10,000 square feet of land the project is the responsibility of the owner under the jurisdiction of the City of Buena Vista. An erosion and sediment control plan must

Ms. M. Denise Doetzer
December 11, 1998
Page Three

be approved prior to any land disturbing activity on site. Plan requirements and approval should be requested through the Natural Bridge Soil and Water Conservation District or the Department of Conservation and Recreation at (804) 786-2556. A separate stormwater management plan may also be required depending on local requirements.

4. Air Quality. Project construction will be subject to regulation by the Department of Environmental Quality. The DEQ - State Air Pollution Control Board's Regulations on the Control and Abatement of Air Pollution is applicable to this project. The specific requirements are:

- 9 VAC 5-50-60 through 9 VAC 5-50-120, governing abatement of fugitive dust emissions; and
- 9 VAC 5-40-5600 through 9 VAC 5-40-5640, governing open-burning control.

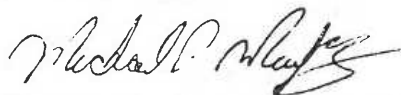
For further information contact DEQ's Valley Regional Office.

5. Historic and Archaeological Resources. The project satisfactorily presents the results of the on-going consultation with the Department of Historic Resources (DHR). No further identification efforts are needed for archaeological properties. DHR looks forward to receiving the results of the architectural survey of the four railroad bridges and one small road bridge proposed for removal or replacement.

When DHR has the additional information, they will be able to advise on the need for any further identification efforts and treatment measures, if appropriate. For further information, contact DHR's Ethel Eaton at (804) 367-2323.

Thank you for the opportunity to comment on the draft recovery plan for the proposed activity. The comments of the reviewing agencies are attached for your review and consideration.

Sincerely,



Michael P. Murphy, Director
Division of Environmental
Enhancement

Ms. M. Denise Doetzer
December 11, 1998
Page Four

Attachments

cc: Robert Collins, City of Buena Vista
William H. Strider, Central Shenandoah PDC
John R. Davy, Jr., DCR
Tracie L. West, VMRC
David H. Dutton, DHR
Tom Mizell, DEQ-VRO
Dona Huang, DEQ-Air
Tracey E. Harmon, DEQ-Water
Melissa S. Porterfield, DEQ-Waste

December 22, 1998

Mr. Michael Murphy, Director
Division of Environmental Enhancement
Virginia Department of Environmental Quality
629 East Main Street
P.O. Box 10009
Richmond, Virginia 23240

RE: Buena Vista Watershed Draft Plan-Environmental Impact Statement, Virginia

Dear Mr. Murphy:

Thank you for your comments on the above referenced project. We are currently responding to the comments received from the interagency and public review and plan to have a final document prepared for signatures in the next few months.

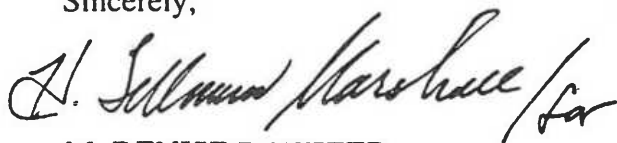
Responses to your comments:

1. Page 1, comments submitted earlier: NRCS will continue to consider the comments submitted for the EA on May 18, 1998. In fact, the Draft Plan-EIS incorporated many of your previous suggestions.
2. Page 2, Stream Impacts: A combination of vegetative cover and hard armor will be used to stabilize the eroding stream banks, as needed, to prevent further debris and bedload to the interior streams within the City of Buena Vista. Since most of the upstream watershed is on U.S. Forest Service land and the interior streams are located immediately adjacent to the residential properties and commercial enterprises within the City of Buena Vista, no flood easements or fee simple acquisition will be part of this project. However, the City of Buena Vista, along with the Shenandoah Valley Planning District Commission and the Virginia Department of Emergency Services, have plans to utilize funding provided by FEMA to acquire, elevate and/or relocate some of the residential properties most affected by flooding. Those nonstructural measures are needed as well as the various structural measures being proposed in this plan.
3. Page 2, railroad bridge at Chalk Mine: The railroad bridge downstream of Route 60 on Chalk Mine Run does not contribute to the flooding at the lower end of this channel. The gradient of Chalk Mine Run decreases significantly when it reaches the floodplain of the Maury River. This reduced gradient causes decreased stream velocity and increased the flow area needed to carry the flood discharge. Under these ponded conditions, the impacts of structures within the channel is very low.

4. Page 2, where feasible implement Rosgen stream methodologies: There are two goals for the proposed channel improvements within Buena Vista: 1) increase the storm flow capacity, and 2) maintain/establish a naturally, functioning channel. It is not possible to achieve both goals with a single design. For this reason, a channel-within-a-channel design has been proposed. The larger channel will be sized to pass the design storm flow without overtopping. This channel will be basically trapezoidal with 2:1 armored side slopes. The armored side slopes are planned for concrete, interlocking blocks that allow for soil placement in the openings and vegetation. Within the bounds of the larger channel, there will be a much smaller stream channel with a dimension and pattern suitable for the planned gradient. Low earthen benches set at the "bankfull" elevation will be used to contain the stream to a size that is capable of bedload transport for events of bankfull proportions or smaller. Design of the interior stream channels will require the use of fluvial geomorphological techniques.
5. Page 2, permitting: NRCS will advise the City of Buena Vista and the Natural Bridge Soil and Water Conservation District, that they will need to coordinate with the Army Corps of Engineers, DEQ and VMRC to determine any appropriate permits that may be required prior to construction of any planned measures.
6. Page 2, erosion and sediment control and/or stormwater management plans: NRCS will coordinate with the City of Buena Vista, the Natural Bridge Soil and Water Conservation District and/or the Virginia Department of Conservation and Recreation in order to comply with local E&S control and stormwater management ordinances.
7. Page 3, air quality: NRCS will include measures in the construction contracts which will ensure compliance with the applicable air quality regulations.
8. Page 3, historic and archaeological resources: NRCS will continue to consult with the Virginia Department of Historic Resources regarding Section 106 of the National Historic Preservation Act of 1966, as amended through 1992. When available, we will provide the results of the architectural survey of the four railroad bridges and one small road bridge proposed for removal and replacement.

I hope this has addressed all of your concerns. Thanks again for your participation in this process. We look forward to working with you further on this worthwhile project.

Sincerely,



M. DENISE DOETZER
State Conservationist

cc: Mr. James A. Carter, Chairman, Natural Bridge SWCD, Lexington
Mr. Robert Collins, Buena Vista City Manager, Buena Vista
Roger Flint, NRC, Lexington
Wade Biddix, Planning Coordinator



COMMONWEALTH of VIRGINIA

Department of Historic Resources

2801 Kensington Avenue, Richmond, Virginia 23221

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

H. Alexander Wise, Jr.
Director

Tel: (804) 367-2323
Fax: (804) 367-2391
TDD: (804) 367-2386

November 5, 1998

M. Denise Doetzer
State Conservationist
USDA Natural Resources Conservation Service
1606 Santa Rosa Road, Suite 209
Richmond, Virginia 23229-5014

RE: Buena Vista Watershed
Watershed Plan - Draft Environmental Impact Statement
City of Buena Vista, Rockbridge County, Virginia
DHR File No. 98-0413-F

Dear Ms. Doetzer:

Thank you for providing us the opportunity to comment on the Watershed Plan and Draft Environmental Impact Statement prepared for the referenced project.

The document satisfactorily presents the results of the on-going consultation with our Department in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended through 1992. No further identification efforts are needed for archeological properties. We look forward to receiving the results of the architectural survey of the four railroad bridges and one small road bridge proposed for removal and replacement.

Once we have the additional information, we will be able to advise you on the need for any further identification efforts and treatment measures, if appropriate. If you have any questions about our comments, please do not hesitate to contact Ethel R. Eaton of our project review staff at (804) 367-2323; fax (804) 367-2924; e-mail eeaton@dhr.state.va.us. We look forward to working with you and the City on this project.

Sincerely,

David H. Dutton, Director
Division of Project Review

c. John Myers, NRCS
Ellie Irons, DEQ

Petersburg Office
10 Courthouse Avenue
Petersburg, VA 23803
Tel: (804) 863-1620
Fax: (804) 863-1627

Portsmouth Office
612 Court Street, 3rd Floor
Portsmouth, VA 23704
Tel: (804) 396-6707
Fax: (804) 396-6712

Roanoke Office
1030 Penmar Avenue, SE
Roanoke, VA 24013
Tel: (540) 857-7585
Fax: (540) 857-7588

Winchester Office
107 N. Kent Street, Suite 203
Winchester, VA 22601
Tel: (540) 722-3427
Fax: (540) 722-7535

UNITED STATES
DEPARTMENT OF
AGRICULTURE

NATURAL
RESOURCES
CONSERVATION
SERVICE

1606 Santa Rosa Road
Suite 209
Richmond, Virginia 23229-5014
Tel. (804) 287-1690
FAX (804) 287-1736

December 22, 1998

Mr. David Dutton, Director
Division of Project Review
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, Virginia 23221

RE: Buena Vista Watershed Draft Plan-Environmental Impact Statement, Virginia

Dear Mr. Dutton:

Thank you for your comments on the above referenced project. We are currently responding to the comments received from the interagency and public review and plan to have a final document prepared for signatures in the next few months.

In response to your comments, we will continue the consultation with your Department regarding Section 106 of the National Historic Preservation Act of 1966, as amended through 1992. When available, we will provide the results of the architectural survey of the four railroad bridges and one small road bridge proposed for removal and replacement.

I hope this has addressed all of your concerns. Thanks again for your participation in this process. We look forward to working with you further on this worthwhile project.

Sincerely,



M. DENISE DOETZER
State Conservationist

cc: Mr. James A. Carter, Chairman, Natural Bridge SWCD, Lexington
Mr. Robert Collins, Buena Vista City Manager, Buena Vista
Roger Flint, NRC, Lexington
Wade Biddix, Planning Coordinator



COMMONWEALTH of VIRGINIA

James S. Gilmore, III
Governor

John Paul Woodley, Jr.
Secretary of Natural Resources

Marine Resources Commission

*2600 Washington Avenue
P.O. Box 756
Newport News, Virginia 23607-0756*

William A. Pruitt
Commissioner

October 23, 1998

Ms. M. Denise Doetzer
USDA - Natural Resources Conservation Service
Culpeper Building, Suite 209
1606 Santa Rosa Road
Richmond, Virginia 23229-5014

Re: Draft Plan - Buena Vista Watershed Plan
Rockbridge County

Dear Ms. Doetzer:

In accordance with your letter dated October 13, 1998, we have reviewed the above-referenced Environmental Impact Statement to reduce flood damage in the Buena Vista Watershed.

The Marine Resources Commission, pursuant to Chapter 12 of Title 28.2 of the Code of Virginia, is responsible for issuing permits for encroachments in, on, or over State-owned submerged lands throughout the Commonwealth. Accordingly, if any portion of the project involves any encroachments channelward of ordinary high water along any natural rivers and streams, a permit may be required from our agency. For your information, we generally only require permits for encroachments on streams with a drainage area greater than 5 square miles or with an average instream flow of 5 cubic feet per second or higher.

From the information provided in the report, it appears that several of the proposed projects outlined in the EIS will require a permit from this agency. Joint Permit Applications are available through this office and can be requested over the telephone.

An Agency of the Natural Resources Secretariat

Telephone (757) 247-2200 (757) 247-2292 V/TDD Information and Emergency Hotline 1-800-541-4646 V/TDD

USDA-Natural Resources Conservation Service
RE: Draft Plan
October 23, 1998

Page Two

Thank you for the opportunity to comment on this project. If we may be of further assistance, please do not hesitate to give us a call.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Traycie L. West', with a long horizontal flourish extending to the right.

Traycie L. West
Environmental Engineer

TLW/kr

HM

cc: Ms. Ellie Irons - DEQ Central Office

UNITED STATES
DEPARTMENT OF
AGRICULTURE

NATURAL
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1606 Santa Rosa Road
Suite 209
Richmond, Virginia 23229-5014
Tel. (804) 287-1690
FAX (804) 287-1736

December 22, 1998

Ms. Traycie L. West
Environmental Engineer
Virginia Marine Resources Commission
2600 Washington Avenue
P.O. Box 756
Newport News, Virginia 23607-0756

RE: Buena Vista Watershed Draft Plan-Environmental Impact Statement, Virginia

Dear Ms. West:

Thank you for your comments on the above referenced project. We are currently responding to the comments received from the interagency and public review and plan to have a final document prepared for signatures in the next few months.

In response to your comments, we will advise the City of Buena Vista and the Natural Bridge Soil and Water Conservation District, that they need to coordinate with your office to determine any appropriate permits that may be required prior to construction of any planned measures.

I hope this has addressed all of your concerns. Thanks again for your participation in this process. We look forward to working with you further on this worthwhile project.

Sincerely,



M. DENISE DOETZER
State Conservationist

cc: Mr. James A. Carter, Chairman, Natural Bridge SWCD, Lexington
Mr. Robert Collins, Buena Vista City Manager, Buena Vista
Roger Flint, NRC, Lexington
Wade Biddix, Planning Coordinator



IN REPLY REFER TO:

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Custom House, Room 244
200 Chestnut Street
Philadelphia, Pennsylvania 19106-2904

December 9, 1998

ER 98/668

M. Denise Doetzer
State Conservationist
Natural Resources Conservation Service
1606 Santa Rosa Road
Suite 209
Richmond, Virginia 23229-5014

Dear Ms. Doetzer:

Thank you for the opportunity to review and comment on the Draft Watershed Plan - Environmental Impact Statement for the City of Buena Vista, Rockbridge, County, Virginia.

The U.S. Department of the Interior has no comment on the adequacy of the document or the merits of the project proposal.

Thank you again for consulting with us about document preparation.

Sincerely,

Michael T. Chezik
Regional Environmental Officer



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

DEC 14 1998

M. Denise Doetzer
State Conservationist
USDA- Natural Resource Conservation Service
Culpeper Building, Suite 209
1606 Santa Rosa Rd
Richmond, VA 23229-5014

Dear Mrs. Doetzer:

In accordance with the National Environmental Policy Act (NEPA), Section 309 of the Clean Air Act, and Section 404 of the Clean Water Act (Section 404), the U.S Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) for the proposed Buena Vista Watershed project located in the City of Buena Vista, Rockingham County, Va. The recommended \$6 million dollar plan is to provide flood protection to a portion of the City of Buena Vista through a series of structural measures to the existing stream channels (5,483 linear feet), culverts and bridges (11), and through the construction of eight debris basins.

After reviewing this document, we have chosen to rate the project and its documentation as EC-2 in EPA's classification system (Environmental Concerns - Insufficient Information). We give this rating due to the lack of a specific description of both the project limits and the resources within the project limits. We also find the document to be lacking in detail regarding the stream channelization design, and in its analysis of non-structural alternatives. With those key elements missing from the document, the reader can not fully understand the impacts and trade-offs of the recommended plan. Our comments are provided in greater detail in the following paragraphs.

To begin, the only map that shows the extent of the project is found in Figure B-2. This map provides a good synoptic look at the project, but the document fails to tie in key aquatic resource information. For example, no sampling station locations are indicated on the mapping. In addition, while a reference to trout habitat is given in the text (page 22-23), no indication is given as to whether the trout occur within the project limits, nor is any additional assessment of the trout resource given in the effects section (page 69). Further, it appears that no sampling of the streams was performed to determine their quality through the use of biological indicators.

Second, there is no empirical documentation of current structural stream habitat conditions and no discussion of the structural habitat after the project is completed. There is reference to maintaining the natural characteristics of the stream within the channel (page 32), but no specific design is given, nor is it clear if the Rosgen methodology will be utilized. EPA recommends the use of the Rosgen method to design the natural stable stream channel. Further,

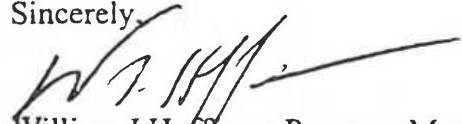
no mention of bottomless arch culverts is given in the list of potential structures on page 33. EPA recommends the use of bottomless arch culverts where feasible. Finally, it is not clear from the document how fish passage will be maintained through the diverter structures associated with the 8 debris basins. This information should be provided in order for the reviewer to assess the impacts of the project.

Finally, non-structural alternatives are discussed (Page 30) and rejected. No cost estimate is given nor are they ranked with the same rigor as are the structural alternatives (pages 44-54 and page 58). Potentially very high costs are suggested for residential relocation, but no data is given. It is indicated in the text (page 15) that this area is suffering from low real estate prices and the decline is expected to continue. Additionally, 89% of the homes were stated to have been built before 1980, and a large percentage of the homes on the flood plain are rented. Further, while the property at risk is evaluated at \$8 million dollars (compared to the project cost of \$6 million dollars), no data is provided on the value of the property at risk in the 5, 25, and 100 year flood plain areas. Finally, the document indicates that less than \$3 million dollars in flood insurance premiums have been paid since 1978. All the above suggest that buy-outs may be economically feasible in some circumstances. This question is not effectively dealt with in the document. It is referenced that the City of Buena Vista along with the Federal Emergency Management Agency (FEMA) is considering some non-structural alternatives on a case by case basis, but no indication of the effect these will have on this projects' scope or need is given.

Given the above, it difficult to make an informed decision regarding the most cost effective and least environmentally damaging flood control alternative for the project area. We recommend that these issues be addressed further as the environmental review process proceeds.

Thank you for this opportunity to comment. If you have any questions please feel free to call Peter Stokely at 703-648-4292. Mr. Stokely is the principle reviewer of this project for EPA.

Sincerely,

A handwritten signature in black ink, appearing to read "W. J. Hoffman", with a long horizontal line extending to the right.

William J Hoffman, Program Manager
NEPA/404 Regulatory Program

UNITED STATES
DEPARTMENT OF
AGRICULTURE

NATURAL
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1606 Santa Rosa Road
Suite 209
Richmond, Virginia 23229-5014
Tel. (804) 287-1690
FAX (804) 287-1736

January 7, 1999

Mr. William J. Hoffman, Program Manager
NEPA/404 Regulatory Program
Environmental Protection Agency, Region III
1650 Arch Street
Philadelphia, PA 19103-2029

RE: Buena Vista Watershed Draft Plan-Environmental Impact Statement, Virginia

Dear Mr. Hoffman:

Thank you for your comments on the above referenced project. We are currently responding to the comments received from the interagency and public review and plan to have a Final Plan-EIS in the next few weeks.

Responses to your comments:

1. Project impacts regarding the extent of the project and the impact on trout resources will be clarified in the Final Plan-EIS. The only known trout waters are in the headwaters of the watershed on U.S. Forest Service land. There are no planned measures, and thus no project impacts, on Forest Service land upstream of the Buena Vista City limits. All of the interior City streams have intermittent flow and oftentimes have dry stream channels. The Virginia Department of Game and Inland Fisheries verifies that the lack of shading and other urban impacts limits habitat for fish and other aquatic species in the downstream sections of the watershed within the proposed project area. They agreed that no stream sampling was needed within the City of Buena Vista.
2. Stream channel design concerns: A combination of vegetative cover and hard armor will be used to stabilize the eroding stream banks, as needed, to prevent further debris and bedload to the interior streams within the City of Buena Vista. There are two goals for the proposed channel improvements within Buena Vista: 1) increase the storm flow capacity, and 2) maintain/establish a naturally functioning channel. It is not possible to achieve both goals with a single design. For this reason, a channel-within-a-channel design has been proposed. The larger channel will be sized to pass the design storm flow without overtopping. This channel will be basically trapezoidal with 2:1 armored side slopes. The armored side slopes are planned for concrete, interlocking blocks that allow for soil placement in the openings and vegetation.

Within the bounds of the larger channel, there will be a much smaller stream channel with a dimension and pattern suitable for the planned gradient. Low earthen benches set at the "bankfull" elevation will be used to contain the stream to a size that is capable of bedload transport for events of bankfull proportions or smaller. Design of the interior stream channels will require the use of fluvial geomorphological techniques.

3. Bottomless culverts are an option and will be used where deemed feasible.
4. Fish passage: After further consultation with the Virginia Department of Game and Inland Fisheries (VDGIF), they conclude that due to the fish species involved, their location within the watershed, stream characteristics, and intermittent flow conditions, fish passage throughout the project area is not a concern. See attached letter from the VDGIF.
5. The non-structural alternatives will be clarified in the Final Plan-EIS. The City of Buena Vista, along with the Shenandoah Valley Planning District Commission and the Virginia Department of Emergency Services, have plans to utilize funding provided by FEMA to acquire, elevate and/or relocate some of the residential properties most affected by flooding. Non-structural alternatives were considered and were rejected as viable alternatives from a large scale (floodplain-wide) perspective due to the following considerations: 1) Early warning systems would not work due to the steep slopes and close proximity between the mountain slopes in the upper-watershed and the City. Floodproofing was also determined to not make much sense as a treatment for most homes given that earthen floodwalls require too much space, masonry floodwalls are too expensive relative to the value of the affected homes, and dry and wet floodproofing would be appropriate for only a small number of properties, but still would only afford protection from minor storm events; 2) Non-structural alternatives require voluntary participation. The most effective non-structural alternatives of a preventive nature, buy-out/demolition, relocation and elevation, were judged to not likely be socially acceptable on a widespread basis. These options are unacceptable because of their disruptive nature to the lives of affected families and individuals and due to the fact that many of those affected worst by flooding in Buena Vista are elderly, limited income people, with few options for relocation. In addition, their homes tend to be older with lower values which makes them less likely to be economically justifiable; and 3) Buy-out/demolition, relocation and elevating were deemed the most effective non-structural alternatives with the ability to prevent and/or diminish flood damages, but assuming a very conservative average cost of \$35,000 per home would have resulted in an estimated project cost of over \$9,625,000 just to protect the 275 properties affected by the 25 year storm event. This alternative would likely cost much more because the average cost for commercial properties would be more than the \$35,000 per structure assumed here. Using the same conservative \$35,000 per home cost for non-structural alternatives, 100 year storm event protection would cost over \$11,900,000. Buena Vista is a relatively small city both in terms of it's physical area occupied and with respect to it's population. Thus, finding sufficient sites for new residences and relocations would also be completely impractical. The Draft Plan-EIS mentioned that non-structural options would be pursued through a hazard mitigation grant proposal sponsored by

the Virginia Department of Emergency Services and FEMA and coordinated with the NRCS project. By using our analysis and data, we assisted them to identify potential properties appropriate for evaluation and inclusion in the project. A total of 39 properties were identified as good candidates to meet the economic defensibility criteria. This effort is intended to complement the broader watershed-wide project proposal from a smaller scale strategic properties focus whereby the properties at greatest risk from recurrent flooding are targeted for buy-out/demolition, relocation and/or elevation. This approach was judged by our Planning Team, the local sponsors and the Virginia Department of Emergency Services, to make the most sense to utilize non-structural alternatives to the maximum extent practical. This effort continues to proceed with 28 homes deemed economically feasible that also have signed voluntary participation forms for the 13 owned and 15 rental properties included. The project proposes to acquire 11 houses and elevate 17 homes which have the potential to receive 2 feet or more of water in the first floor from the 100 year storm event. The total estimated project cost is \$1,160,176 or \$41,435 per home. These investments are considered non-project actions from the PL-566 perspective and thus the associated benefits and costs have been excluded from the Buena Vista Watershed Plan-EIS. However, as already noted, the non-structural hazard mitigation project was an outgrowth of the coordinated whole-watershed planning process which the NRCS led. In conclusion, the nonstructural measures are needed as well as the various structural measures being proposed in this Plan-EIS.

I hope this has addressed all of your concerns. The Final Plan-EIS will be revised to reflect your suggestions as deemed appropriate. Thanks again for your participation in this process. We look forward to working with you further on this worthwhile project.

Sincerely,


M. DENISE DOETZER

Acting State Conservationist

Attachment

cc: Mr. James A. Carter, Chairman, Natural Bridge SWCD, Lexington
Mr. Robert Collins, Buena Vista City Manager, Buena Vista
Roger Flint, NRC, Lexington
Wade Biddix, Planning Coordinator, Richmond



COMMONWEALTH of VIRGINIA

Department of Game and Inland Fisheries

4725 LEE HIGHWAY
P.O. BOX 996
VERONA, VA 24482-0996
(703) 248-9360 FAX (703) 248-9399

M E M O R A N D U M

TO: John Meyers

FROM: Larry Mohn

DATE: January 6, 1999

SUBJECT: Buena Vista debris dams

This is in reference to your request for information concerning the need for fish passage at the proposed debris dams on four tributaries within the city of Buena Vista. All four of these streams are intermittent within the city limits and generally only flow during wet periods. Reservoir Hollow and Pedlar Gap Run both have relatively good populations of native brook trout at higher elevations. Associated species include blacknose dace, torrent suckers, bluehead chub and mottled sculpin. The only likely fish movement under current conditions is downstream during high flow periods. Stream conditions further downstream are generally not suitable for survival of trout so few fish would be available to migrate back if conditions were suitable. The other species could survive at lower elevations but movement back upstream does not currently appear likely. I see no need to include fish passage in these structures based on the data we have available.



DEPARTMENT OF THE ARMY
NORFOLK DISTRICT, CORPS OF ENGINEERS
FORT NORFOLK, 803 FRONT STREET
NORFOLK, VIRGINIA 23510-1096

REPLY TO
ATTENTION OF:

December 21, 1998

Western Virginia Regulatory Section
98-H0201-75 (Chalk Mine Run, etc.)

Ms. M. Denise Doetzer, State Conservationist
Natural Resources Conservation Service
USDA
1606 Santa Rosa Road
Suite 209
Richmond, Virginia 23229-5014

Dear Ms. Doetzer:

This is in response to your letter and Watershed Plan-Environmental Impact Statement entitled "Buena Vista Watershed", in which you requested comments from various agencies. After review of the proposed watershed protection and flood prevention project we have determined that your project may impact the channels of Chalk Mine Run, Indian Gap Run, Noel's Run, and Pedlar Gap Run.

This is formal notice that any discharge of dredged or fill material below the ordinary high water mark of "waters of the U. S." and into any adjacent wetlands will require prior coordination with this office to determine any appropriate Department of the Army permit(s) that may be required. In addition there may be permits required from the Virginia Department of Environmental Quality and the Virginia Marine Resources Commission.

We would recommend a preapplication meeting and/or site meeting prior to applying for a DOD permit. If you have any further questions you may contact Mr. Brogdon of in Staunton at (540) 886-4221.

Sincerely,

for James J. Brogdon
J. Robert Hume III, Chief

Western Virginia Regulatory Section

Copies furnished:

Virginia Department of Environmental Quality, Harrisonburg
Virginia Marine Resources Commission, Newport News

UNITED STATES
DEPARTMENT OF
AGRICULTURE

NATURAL
RESOURCES
CONSERVATION
SERVICE

1606 Santa Rosa Road
Suite 209
Richmond, Virginia 23229-5014
Tel. (804) 287-1690
FAX (804) 287-1736

December 22, 1998

Mr. J. Robert Hume, III, Chief
Western Virginia Regulatory Section
Department of the Army
Norfolk District, Corps of Engineers
Fort Norfolk, 803 Front Street
Norfolk, Virginia 23510-1096

RE: Buena Vista Watershed Draft Plan-Environmental Impact Statement, Virginia

Dear Mr. Hume:

Thank you for your comments on the above referenced project. We are currently responding to the comments received from the interagency and public review and plan to have a final document prepared for signatures in the next few months.

In response to your comments, we will advise the City of Buena Vista and the Natural Bridge Soil and Water Conservation District, that they need to coordinate with your office to determine any appropriate permits that may be required prior to construction of any planned measures. We would welcome a preapplication meeting and/or site meeting prior to applying for a permit.

I hope this has addressed all of your concerns. Thanks again for your participation in this process. We look forward to working with you further on this worthwhile project.

Sincerely,



M. DENISE DOETZER
State Conservationist

cc: Mr. James A. Carter, Chairman, Natural Bridge SWCD, Lexington
Mr. Robert Collins, Buena Vista City Manager, Buena Vista
Roger Flint, NRC, Lexington
Wade Biddix, Planning Coordinator



UNITED STATES DEPARTMENT OF COMMERCE
Office of the Under Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

October 30, 1998

Ms. Denise Doetzer
State Conservationist
1606 Santa Rosa Road
Suite 209
Richmond, Virginia 23229-5014

Dear Ms. Doetzer:

Enclosed are comments on the Draft Environmental Impact Statement for Buena Vista Watershed Plan City of Buena Vista Rockridge County, Virginia. We hope our comments will assist you. Thank you for giving us an opportunity to review this document.

Sincerely,

Susan B. Fruchter
Acting NEPA Coordinator

Enclosure



Printed on Recycled Paper



MEMORANDUM FOR: Susan B. Fruchter
Acting NEPA Coordinator

FROM: Charles W. Challstrom
Acting Director, National Geodetic Survey

SUBJECT: DEIS-9810-07-Buena Vista Watershed Plan City of Buena Vista
Rockridge County, Virginia

The subject statement has been reviewed within the areas of the National Geodetic Survey's (NGS) responsibility and expertise and in terms of the impact of the proposed actions on NGS activities and projects.

All available geodetic control information about horizontal and vertical geodetic control monuments in the subject area is contained on the NGS home page at the following Internet World Wide Web address: <http://www.ngs.noaa.gov>. After entering the NGS home page, please access the topic "Products and Services" and then access the menu item "Data Sheet." This menu item will allow you to directly access geodetic control monument information from the NGS data base for the subject area project. This information should be reviewed for identifying the location and designation of any geodetic control monuments that may be affected by the proposed project.

If there are any planned activities which will disturb or destroy these monuments, NGS requires not less than 90 days' notification in advance of such activities in order to plan for their relocation. NGS recommends that funding for this project includes the cost of any relocation(s) required.

For further information about these monuments, please contact Rick Yorczyk; SSMC3, NOAA, N/NGS; 1315 East West Highway; Silver Spring, Maryland 20910; telephone: 301-713-3230 x142; fax: 301-713-4175.

UNITED STATES
DEPARTMENT OF
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NATURAL
RESOURCES
CONSERVATION
SERVICE

1606 Santa Rosa Road
Suite 209
Richmond, Virginia 23229-5014
Tel. (804) 287-1690
FAX (804) 287-1736

December 22, 1998

Ms. Susan B. Fruchter
Acting NEPA Coordinator
U.S. Department of Commerce
Office of the Under Secretary for Oceans and Atmosphere
Washington, D.C. 20230

RE: Buena Vista Watershed Draft Plan-Environmental Impact Statement, Virginia

Dear Ms. Fruchter:

Thank you for your comments on the above referenced project. We are currently responding to the comments received from the interagency and public review and plan to have a final document prepared for signatures in the next few months.

In response to your comments, we will identify the locations and designations of any geodetic control monuments that may be affected by the proposed project. We will notify the National Geodetic Survey in advance if any planned activities will potentially disturb or destroy these monuments.

I hope this has addressed all of your concerns. Thanks again for your participation in this process.

Sincerely,

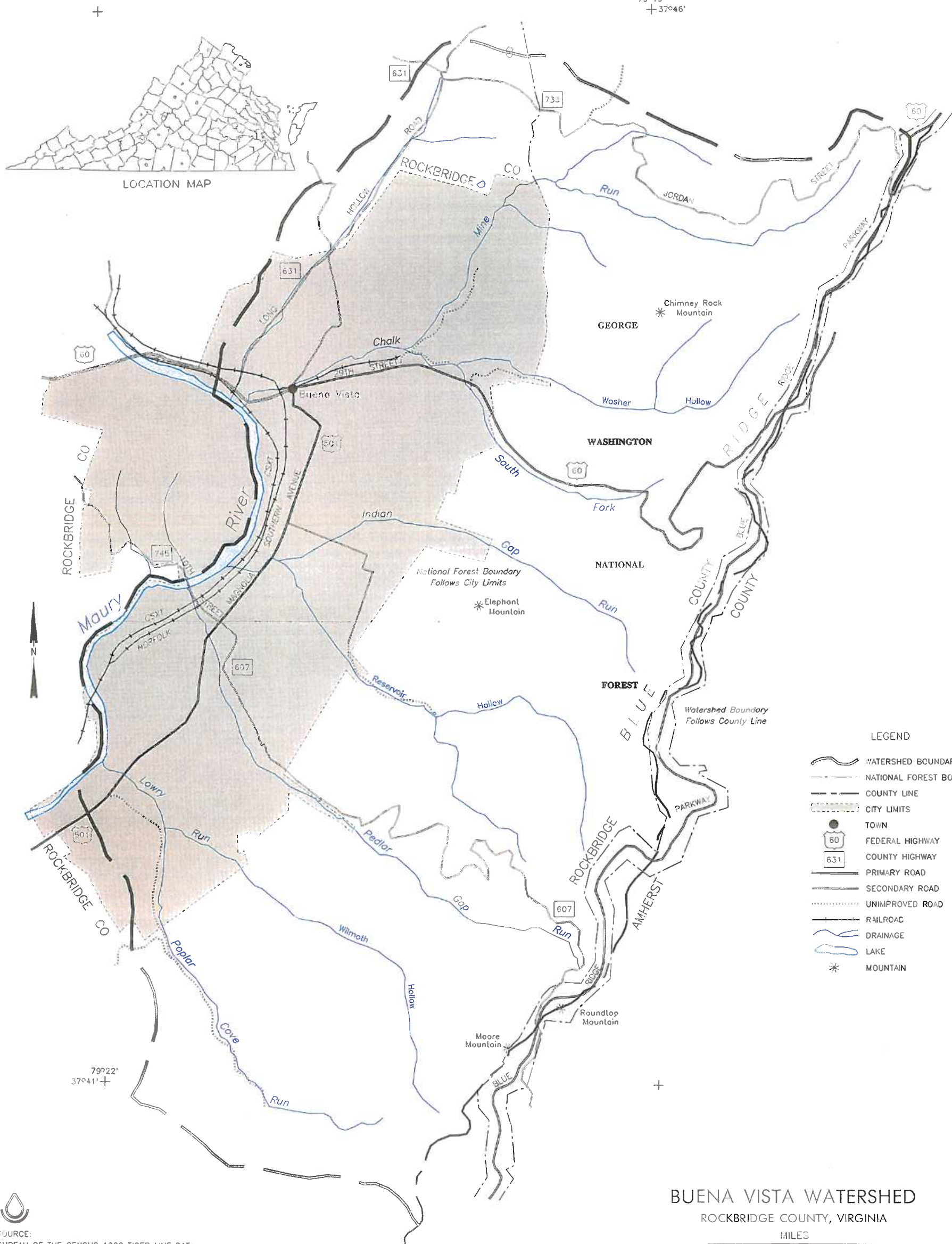


M. DENISE DOETZER
State Conservationist

cc: Mr. James A. Carter, Chairman, Natural Bridge SWCD, Lexington
Mr. Robert Collins, Buena Vista City Manager, Buena Vista
Roger Flint, NRC, Lexington
Wade Biddix, Planning Coordinator

APPENDIX B

FLOODPLAIN MAPS

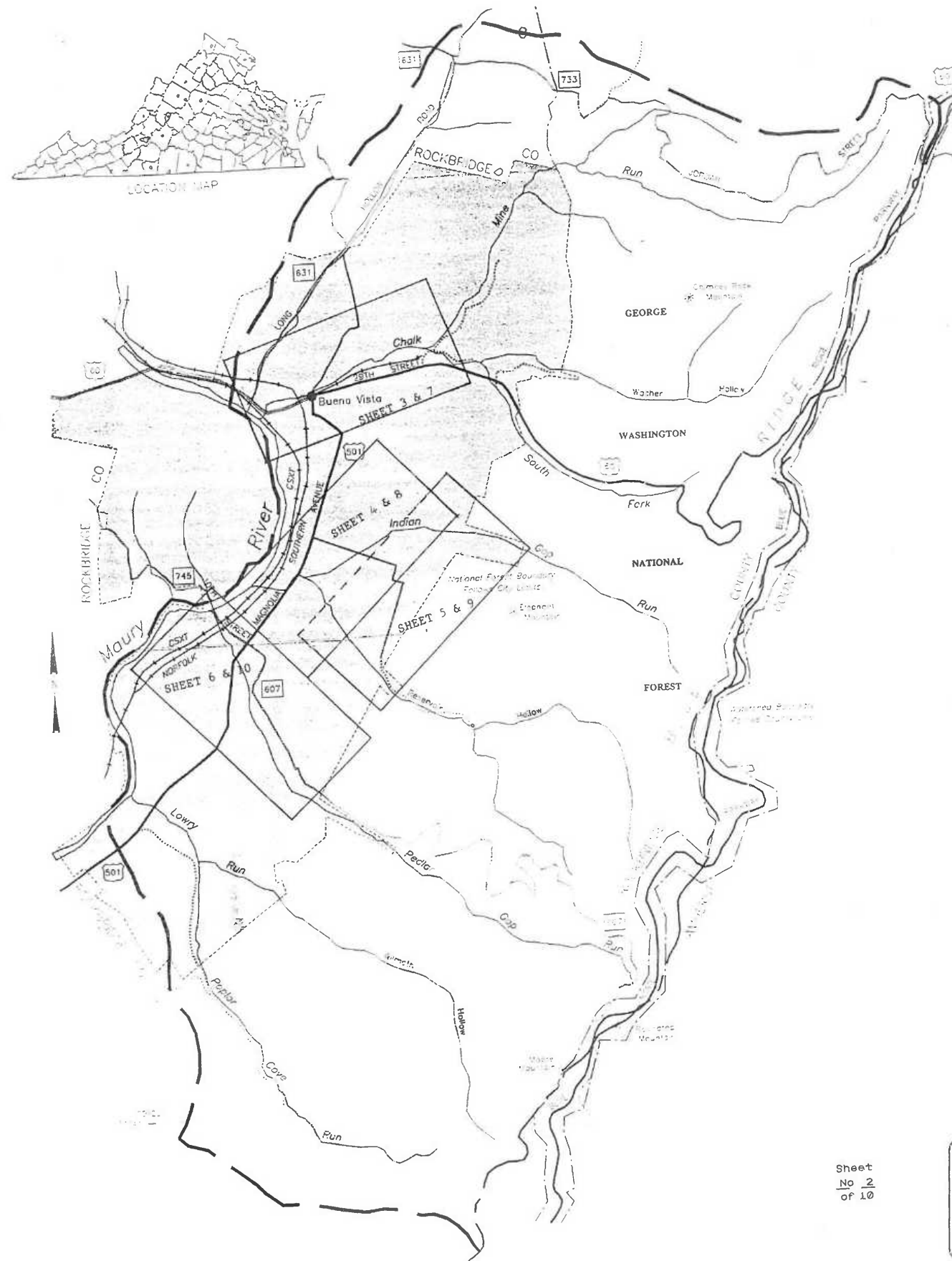


SOURCE:
BUREAU OF THE CENSUS 1990 TIGER LINE DATA
AND 1:24,000 U.S.G.S. QUADRANGLES.
LATITUDE AND LONGITUDE GEOGRAPHIC COORDINATE SYSTEM
NATIONAL CARTOGRAPHY AND GEOGRAPHIC INFORMATION
SYSTEMS CENTER, FORT WORTH, TEXAS, 1994.

Sheet
No 1
of 12

BUENA VISTA WATERSHED
ROCKBRIDGE COUNTY, VIRGINIA





FLOOD CONTROL STUDY For BUENA VISTA, VIRGINIA Rockbridge County, Virginia

Date December, 1997

SHEET	INDEX
1	Cover Sheet
2	Overview of Improvements
3	Chalk Mine Run, Future Without Project
4	Indian Gap Run & Noel's Run, Future Without Project
5	Indian Gap Run & Noel's Run, Future Without Project
6	Pedlar Gap Run, Future Without Project
7	Chalk Mine Run, Future With Project
8	Indian Gap Run & Noel's Run, Future With Project
9	Indian Gap Run & Noel's Run, Future With Project
10	Pedlar Gap Run, Future With Project

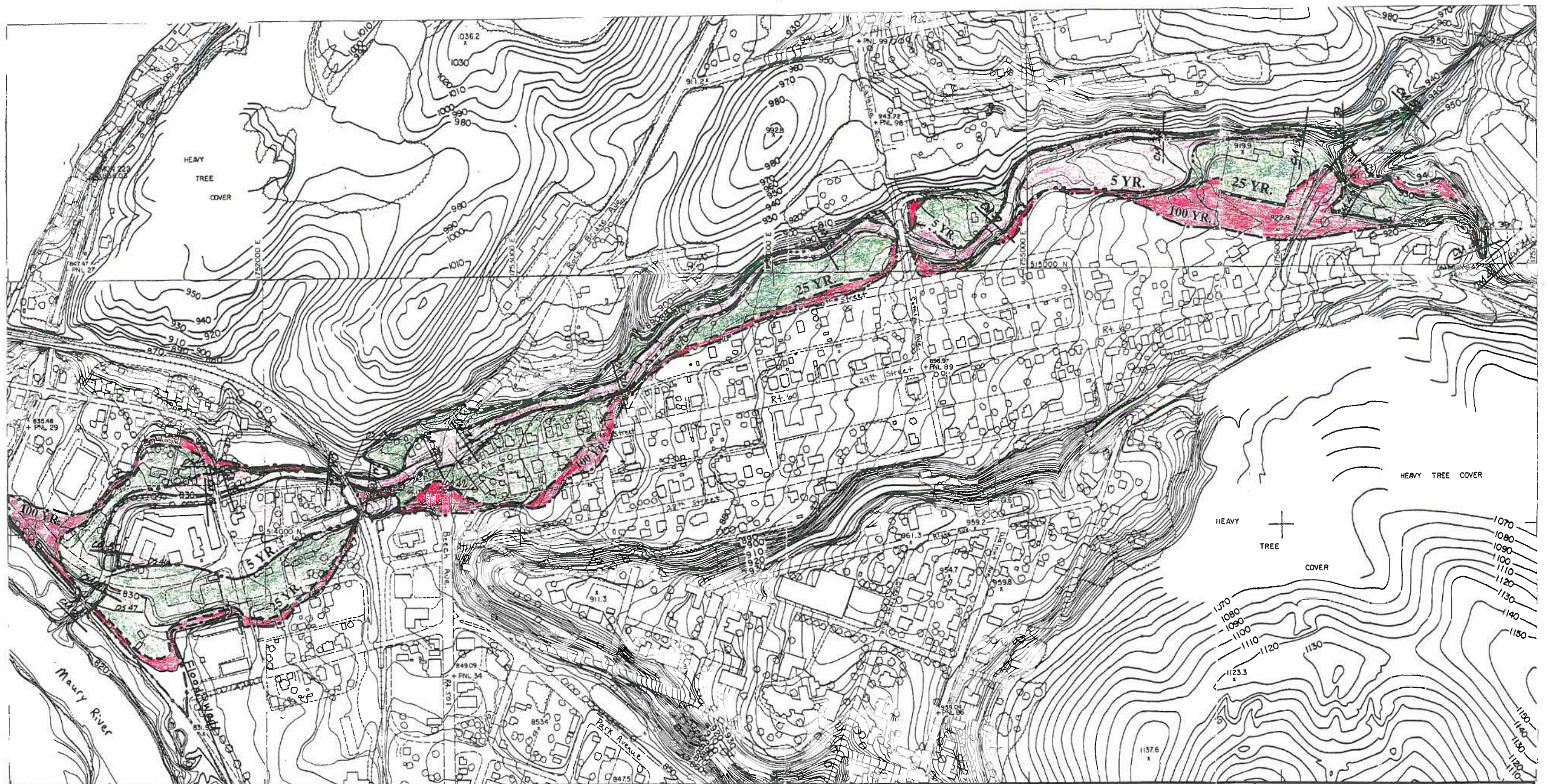
USDA- NATURAL RESOURCES CONSERVATION SERVICE
1606 Santa Rosa Road, Suite 209
Richmond, Virginia 23229-5014
Phone: (804) 287-1691

NILES & ASSOCIATES

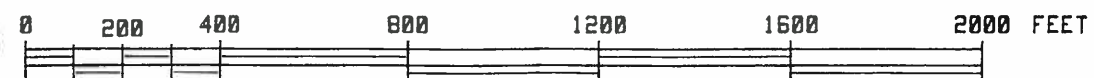
435 APPERSON DRIVE 170 E. REYNOLDS RD.
SALEM, VIRGINIA 24153 LEXINGTON, KENTUCKY 40503

Sheet
No. 2
of 10

THE ORIGINAL HYDROLOGY & HYDRAULIC MODELS WERE DONE BY DEWBERRY & DAVIS OCTOBER 1996 WITH PORTIONS REVISED BY USDA - NATURAL RESOURCES CONSERVATION SERVICE SEPTEMBER 1997. PHOTOGRAPHIC MAPPING AND FIELD SURVEYS PREPARED BY NILES & ASSOCIATES WITH A CONTOUR INTERVAL OF 2 FEET.



CHALK MINE RUN
5, 25 And 100 Year Floodplain
Future Without Project Conditions

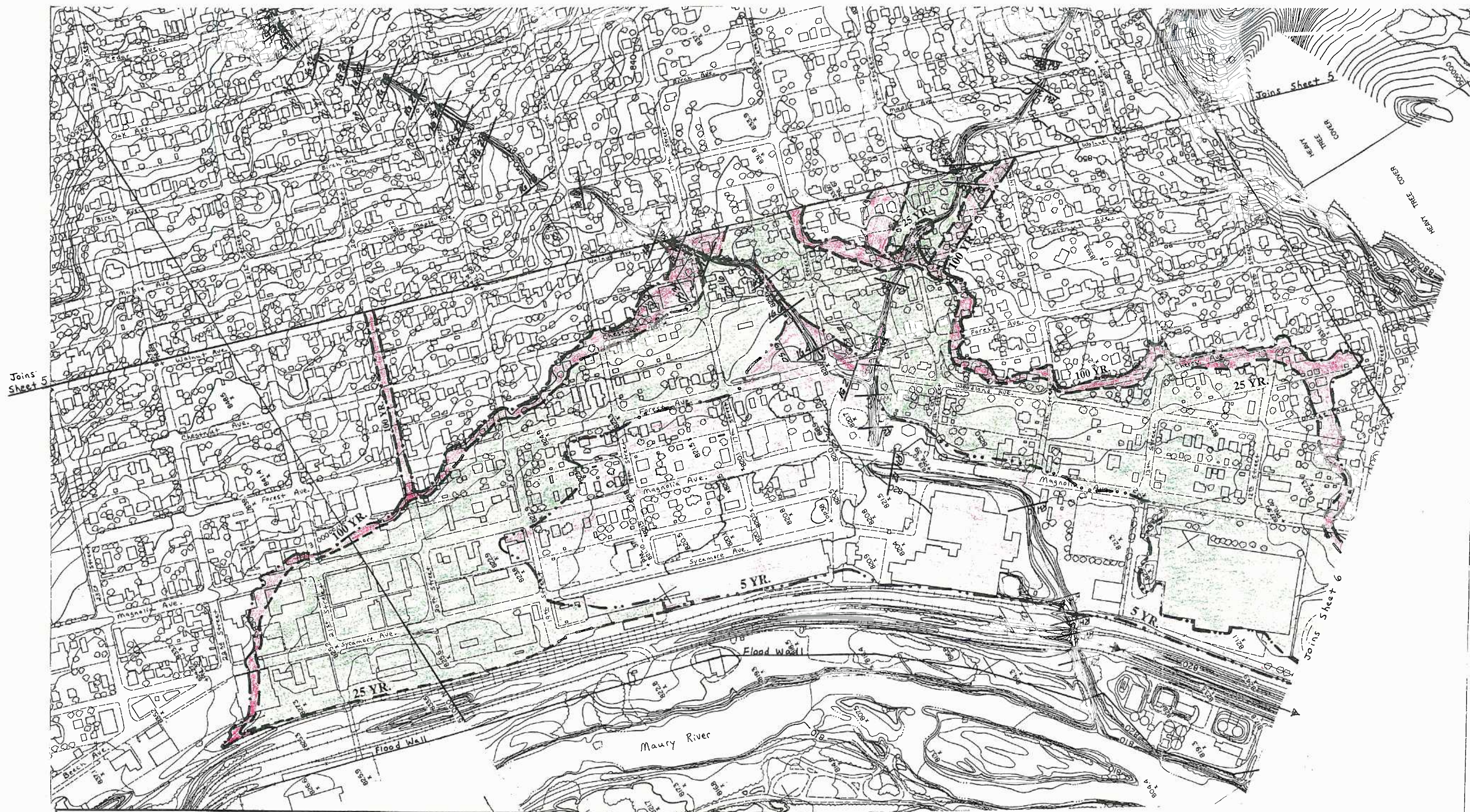


FLOOD-CONTROL STUDY
For
BUENA VISTA, VIRGINIA
Rockbridge County, Virginia

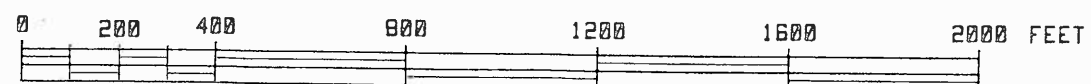
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INDIAN GAP RUN AND NOEL'S RUN
5, 25 And 100 Year Floodplain
Future Without Project Conditions

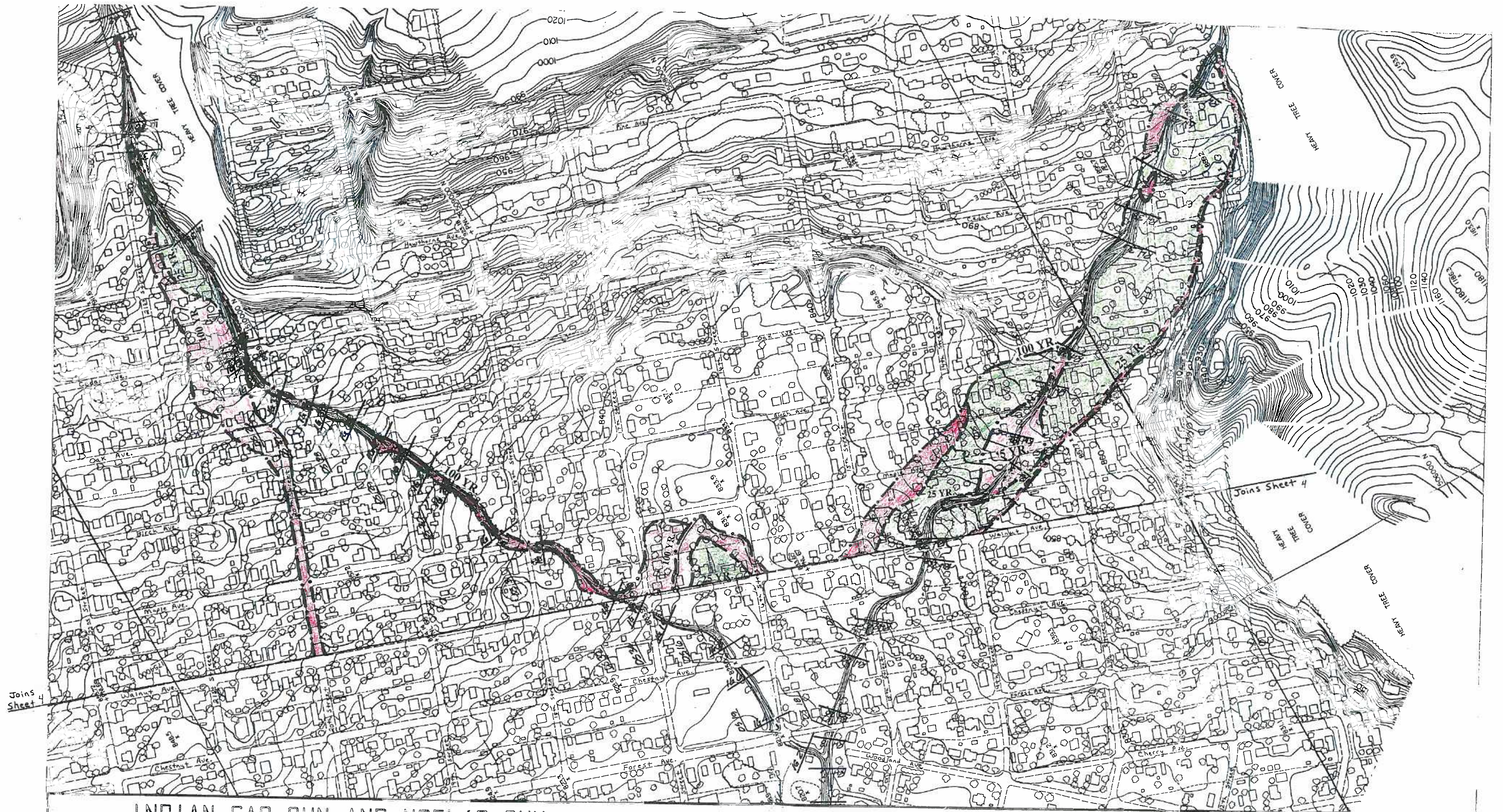


FLOOD CONTROL STUDY
For
BUENA VISTA, VIRGINIA
Rockbridge County, Virginia

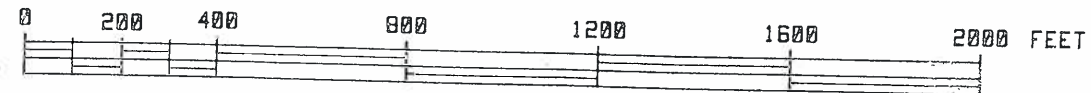
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INDIAN GAP RUN AND NOEL'S RUN
5, 25 And 100 Year Floodplain
Future Without Project Conditions

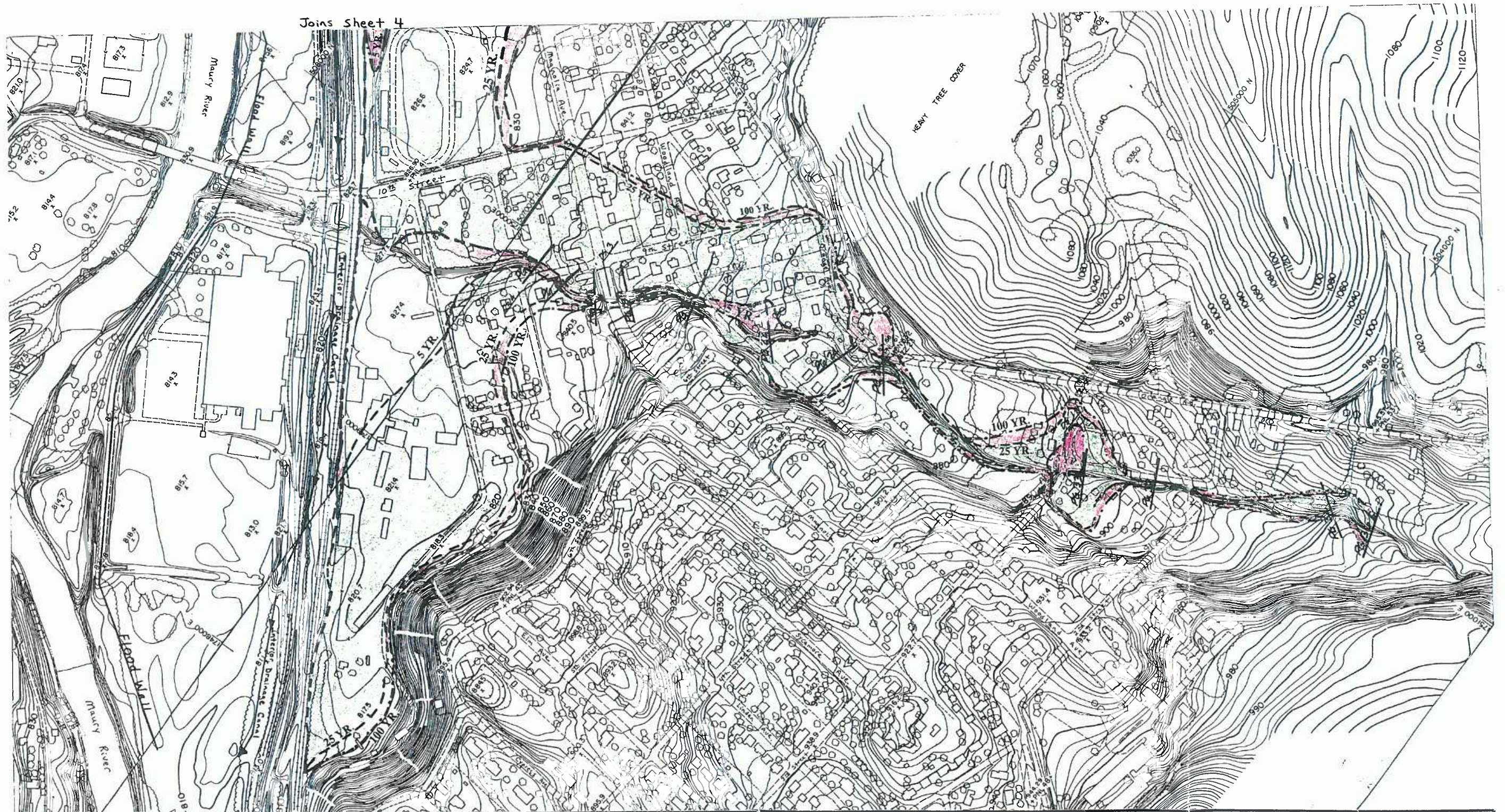


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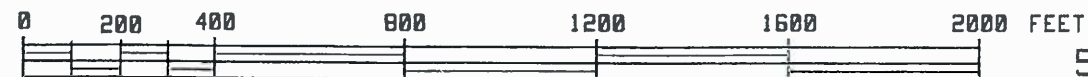
FLOOD CONTROL STUDY
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Rockbridge County, Virginia

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PEDLAR GAP RUN
5, 25 And 100 Year Floodplain
Future Without Project Conditions



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25 YEAR



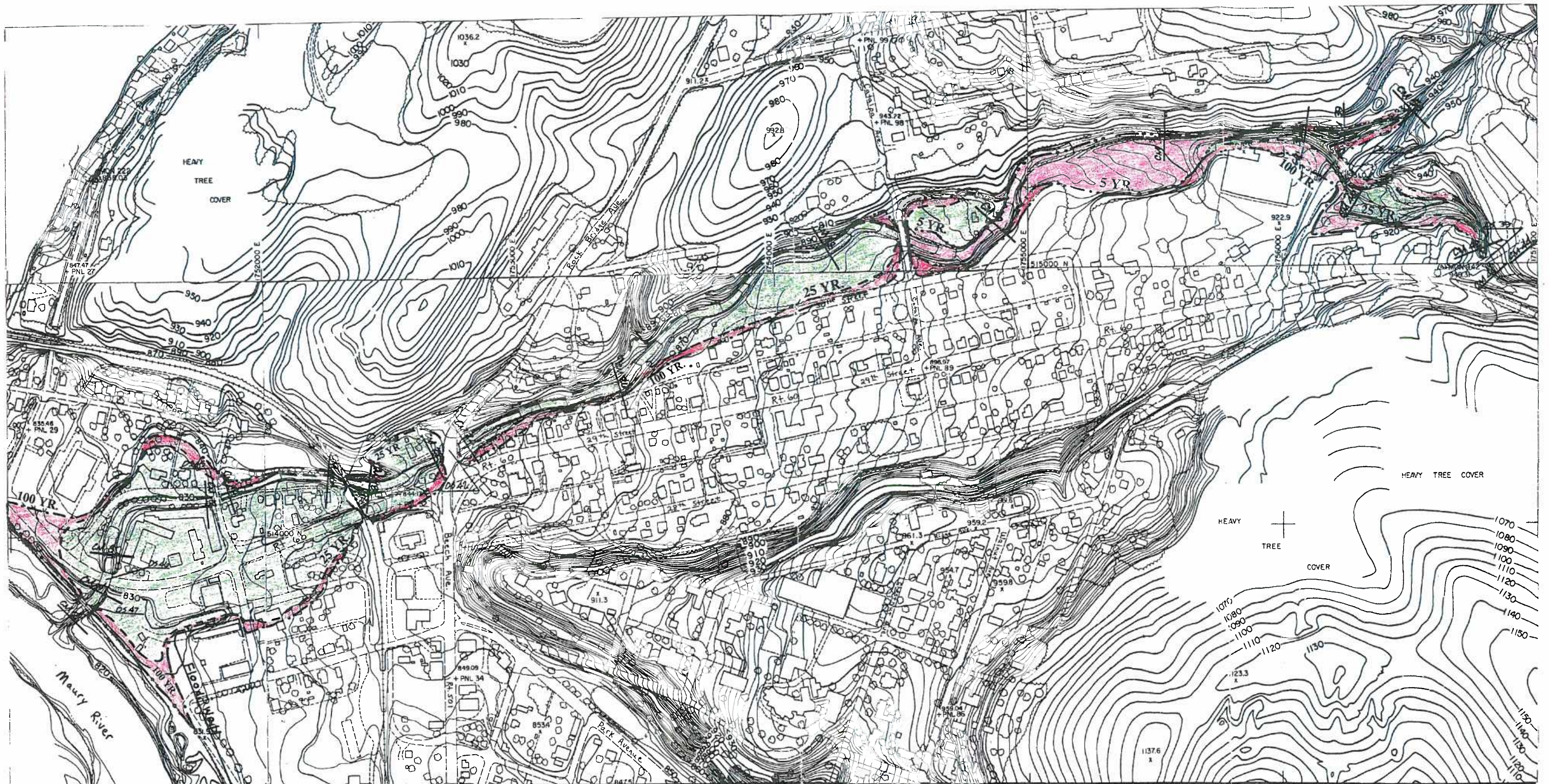
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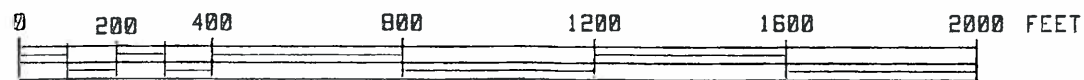
FLOOD CONTROL STUDY
For
BUENA VISTA, VIRGINIA
Rockbridge County, Virginia

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CHALK MINE RUN
5, 25 And 100 Year Floodplain
Future With Project Conditions



FLOOD-CONTROL STUDY
For
BUENA VISTA, VIRGINIA
Rockbridge County, Virginia

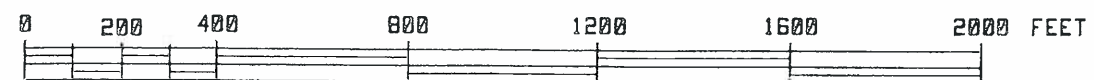
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INDIAN GAP RUN AND NOEL'S RUN
5, 25 And 100 Year Floodplain
Future With Project Conditions

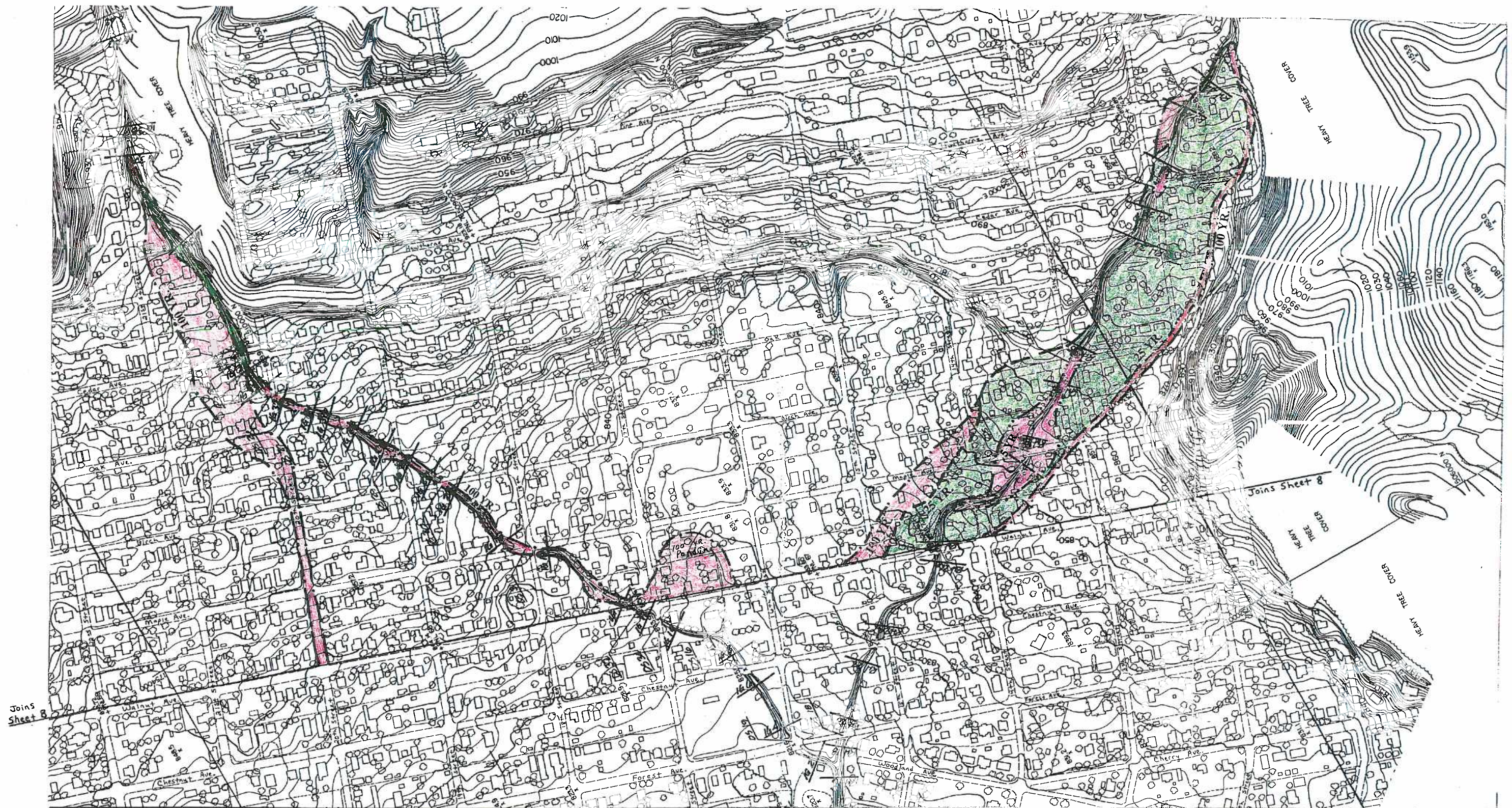


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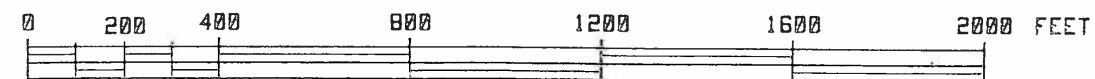
FLOOD CONTROL STUDY For BUENA VISTA, VIRGINIA Rockbridge County, Virginia

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INDIAN GAP RUN AND NOEL'S RUN
5, 25 And 100 Year Floodplain
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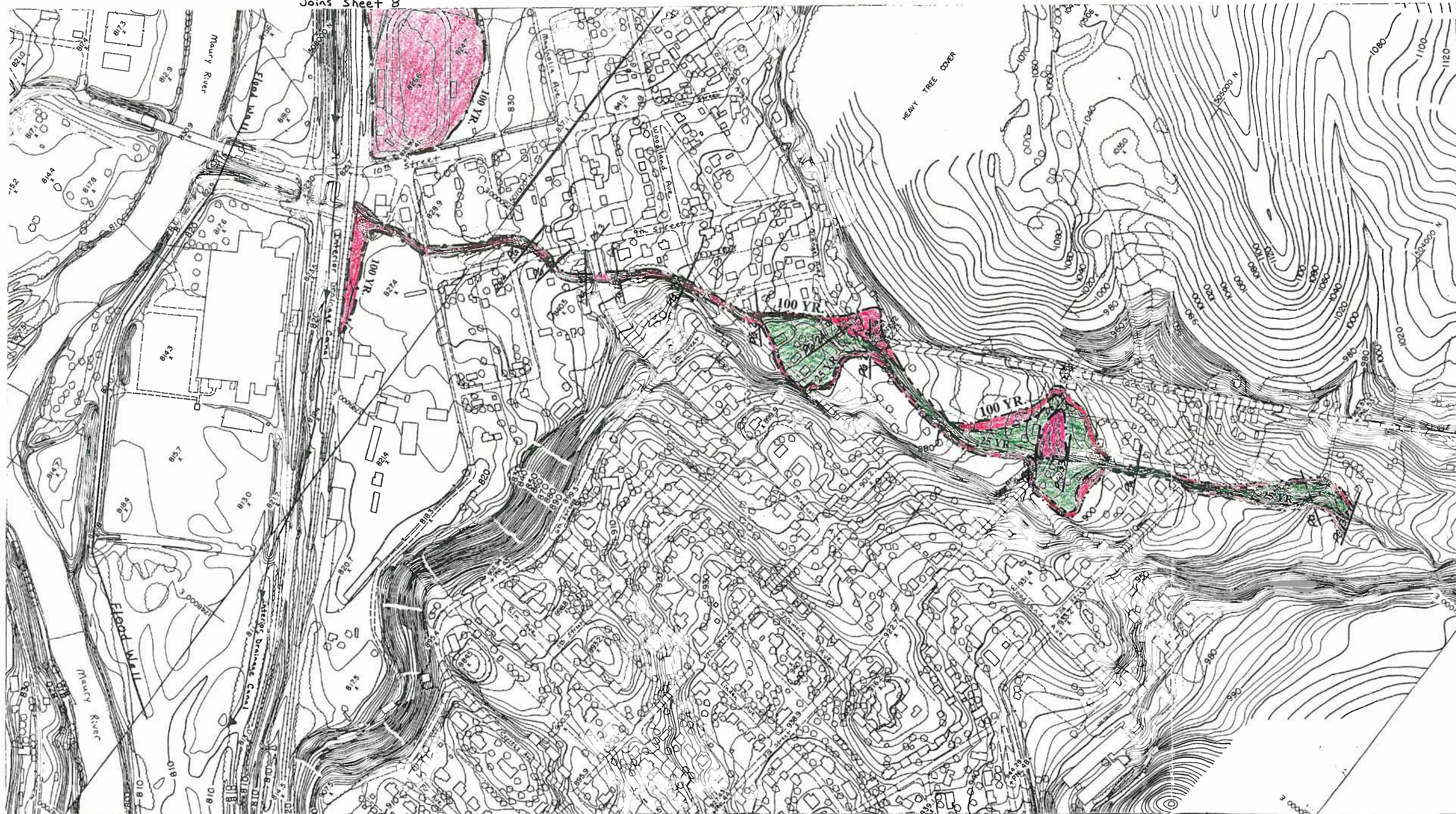
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FLOOD CONTROL STUDY
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Rockbridge County, Virginia

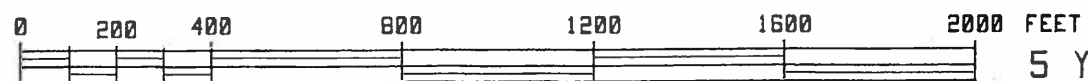
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		of 10

Joins Sheet B



PEDLAR GAP RUN
5, 25 And 100 Year Floodplain
Future With Project Conditions



5 YEAR



25 YEAR



100 YEAR



FLOOD CONTROL STUDY
For
BUENA VISTA, VIRGINIA
Rockbridge County, Virginia

U.S. DEPARTMENT OF AGRICULTURE
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APPENDIX C

INVESTIGATION AND ANALYSIS REPORT

Appendix C

Investigation and Analysis Report

Project Formulation

The project was formulated to address the problem of flooding in the City of Buena Vista. The upper watershed is very steep and mountainous and the runoff empties into a floodplain that is all urban. The physically and economically feasible measures which are socially acceptable were limited to structural measures associated with the reduction of intercity stream flooding. These measures included debris basins, berms, floodwalls, channel improvements and bridge upgrades. Large floodwater retarding structures were not considered feasible or acceptable by the local residents. The nonstructural measures are being implemented by the City through some Federal, State and local funding mechanisms, including FEMA, Flood Mitigation Program, and Community Block Grants. Therefore, NRCS only looked at the structural measures. The formulation of the project resolves to finding the combination of measures which will maximize flood damage reduction with the physical, environmental, and economic constraints.

The formulation process consisted of dividing the hydrologic unit into four distinct subwatersheds. These subwatersheds were then subdivided into hydrologic reaches. The hydrologic reaches were then evaluated individually using hydrology and hydraulics models to produce outputs usable in economic models. The type, number, and location of the structural measures were evaluated by multiple computer iterations in order to produce the best combination of measures to maximize the flood damage reduction. Various combinations of these structures were then analyzed to determine the NED Plan and the Recommended Plan.

Physical and Environmental Constraints

The four intercity streams run directly through the City of Buena Vista. Due to the locations of the streams being immediately adjacent to residential and commercial properties, there were some limitations regarding what could reasonably be done to correct the flooding problems. The streams have multiple road crossings using bridges and culverts which tend to clog with debris during storm events. Due to the relatively flat topography in the floodplain and the landscape modifications throughout the City, once the floodwaters got out of the channel, they typically did not get back in right away. This resulted in flooding problems that were hard to predict where they would occur and what was the best way to solve them.

Environmental concerns were identified during the project scoping process. Threatened and endangered species, fish and wildlife habitat, visual resources, wetlands, and cultural resources were identified as concerns. During field visits and preliminary site selections, it was determined that no wetlands would be impacted.

The U.S. Fish and Wildlife Service and the State of Virginia were contacted to provide lists of endangered and candidate species which might be impacted by proposed measures. No species were found and no impacts anticipated.

The Virginia Department of Game and Inland Fisheries were consulted regarding known trout streams in the area. They are all located in the headwaters of the streams and will not be impacted.

The Virginia Department of Historic Resources (DHR) were consulted regarding the archaeological and historical resources within the project area. Several cultural resources were noted in the area. In formal comments from DHR, they stated that no further identification efforts are needed for archaeological properties. However, several bridges will be surveyed and consultation with the State Historic Preservation Officer will be required within the construction limits of the proposed project.

Land Use

Land use data were gathered by the Natural Resource Conservationist and U.S. Forest Service Personnel. These data were confirmed and refined during field inventories and computer modeling.

Forestry

Information on timber types and timber stand conditions was obtained from the Forest Service timber database Continuous Inventory of Stand Condition. Other forest resource information came from compartment prescription folders on file in the Glenwood/Pedlar Ranger District Office. Management area allocations were from the Revised Land and Resource Management Plan for the George Washington National Forest (1993).

Estimates of water yield increases resulting from loss of vegetation in the watersheds were derived from a model in Douglas and Swank (1972). This model was modified to reflect local base water yields and local pine/hardwood mixes.

Hydraulics and Hydrology

Channel and Valley Cross-sections

In 1985, Niles & Associates used aerial photography to produce a topographic map with one foot contours. At that time, cross-sections were taken along each of the stream channels. The bridges and culverts existing at that time were also surveyed. In 1995, 1996, and 1997, additional work was done to survey the bridges and culverts that had changed since 1985. There was also some channel survey work since changes were made in the channel shapes during various flood recovery efforts.

The most important change to Indian Gap Run is that the City plans to install a concrete-lined channel from Cedar Avenue to Chestnut Avenue. This channel was designed by Mattern & Craig. The cross-sections used in the analysis of this reach were taken from the Mattern & Craig design.

Hydraulics

Water surface profiles were developed using the Corps of Engineers Program HEC-2. This program computes water surface profiles for one-dimensional steady, gradually varied flow in rivers. Flow may be subcritical or supercritical. For Indian Gap Run, the flow was treated as supercritical along the length of the proposed concrete channel and subcritical along other reaches. The other three channels were modeled as subcritical flow only.

Manning's roughness coefficient, n , was determined by field examination and by the tables in *Open Channel Hydraulics* by Chow. Floodplain n values were based on the land use in the floodplain.

Hydrology

The hydrologic conditions were determined by using soil maps and soil hydrologic groups. Runoff curve numbers were computed from the soil complex data. There are no anticipated changes in the watershed land usage in the future.

Weather Bureau Technical Paper No. 40 was used to determine the amount and frequency of rainfall for storms of 24-hour duration. These rainfall amounts were for frequencies ranging from 2 years to 100 years.

To determine the discharge for each storm event modeled, the Corps of Engineers HEC-1 computer model was used. This model simulates the surface runoff response of a river basin to precipitation. Output from this model gives the streamflow hydrograph at selected locations in the river basin.

Times of concentration for each watershed were computed using Worksheet 3 from TR-55.

Engineering Design and Cost Estimates

From the water surface profiles, two types of flooding problem were identified: ponded water and out-of-bank flow. Potential causes of each condition were also identified. These causes included 1) lack of capacity in the structure, 2) lack of capacity in the channel, and 3) grade changes in the channel. In some cases, the true problem at a given site was masked by the larger problem nearby. An example of this would be the culvert on Indian Gap Run at Forest Avenue. The culvert is not big enough to carry the storm water flow but since the road is inundated by backwater from the undersized railroad bridges, there is nothing that can be done at Forest Avenue to improve the culvert capacity.

In the case of inadequate structure capacity, the preferred solution is to replace the bridge or culvert with a larger structure. This would allow the traffic pattern for automobiles and trains to continue unchanged. However, in one case on Pedlar Gap Run, an abandoned bridge will be removed altogether.

Where the water is escaping the channel due to inadequate channel capacity, a two-part design was used. Since the overall goal is to keep the water in the channel, large, lined channels were designed. However, since streams with wide, shallow flows cannot carry the bedload, a channel-within-a-channel approach was used. An earthen bench will be formed within each large channel to force the baseflow water to flow in a relatively small area. This will increase the velocities within the stream and maintain the

bedload capacity. The elevation of the bench will be no higher than the "bankfull" elevation, as defined by Rosgen.

On Pedlar Gap Run, there is an opportunity to increase the carrying capacity of the stream by increasing the grade. Significant improvements can be achieved with this work.

For Indian Gap Run, the majority of the damage is caused by ponding in the lower part of the drainage. Again, this is a two part problem. There are two railroad bridges at the lower end of the channel that have very limited capacity. The embankments of these bridges are high and the water has nowhere to go. In addition, the grade of the ponded channel is very flat. This flatter area is the floodplain of the Maury River. The proposed improvements include replacement of the two railroad bridges with culverts and some channel improvement and grade changes. The actual design of the railroad improvements will be done by an A&E firm with oversight from Norfolk Southern Railroad.

For the purposes of this report, it was necessary to make some assumptions about the characteristics of each channel alteration. The final design may be considerably different. Both vehicular bridges and railroad bridges will be designed by an appropriate A&E firm. Channel improvements will be designed by NRCS.

Installation Costs

Installation costs were estimated from recent contracting experience and from estimates provided by the Virginia Department of Transportation and Norfolk Southern Railroad.

Water Quality

There will be very little project impact on the water quality in Buena Vista during low flow periods. During flood events, there will still be a significant debris loading.

Social Resources

Sources for the social resources assessment include the Buena Vista Storm Drainage/Flood Control Survey conducted by the Natural Bridge Soil and Water Conservation District in October, 1992, the Buena Vista Land Book (1994), the U.S. Census Bureau, Department of Commerce, 1992 Census, the Central Shenandoah Planning District Commission (Economic Overview, 1995 of Rockbridge County and the Cities of Buena Vista and Lexington, December, 1995), U.S. Department of Labor Statistics, National Flood Insurance policy data from the Federal Emergency Management Agency (FEMA), the 1992 Donnelly Report, and the Virginia Department of Game and Inland Fisheries (recreation information).

Economics

Two economic analysis methodology guidance documents were used to evaluate damages, project benefits and costs: "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies", U.S. Water Resources Council, March, 1983, and the "Economics Handbook, Part II for Water Resources", USDA/Soil Conservation Service, March, 1987. The first of these documents was developed to provide consistent project formulation and evaluation guidance for all federal agencies that carryout water and related land resource implementation studies. The basic requirement of the "Principles and Guidelines", or P&G as the document is commonly referred to, is that benefits from project actions must exceed project costs. P&G also requires that the "National Economic Development" or NED alternative, which maximizes net benefits, be selected for implementation unless there is an overriding reason for selecting another alternative based on federal, state, local or international concerns. NRCS policy specifies the criteria for selecting a plan other than the NED plan.

Methods used in making the economic investigations and analyses followed those approved by the Natural Resources Conservation Service for the benefit/cost evaluation of land and water resources. Basic data were obtained from field surveys, interviews with residents, businesses and local government officials within the watershed, and from the secondary data sources listed above. Detailed data on the homes and other structures within the floodplain of Buena Vista were obtained from the office of the Commissioner of the Revenue for the City. Detailed data on infrastructure damages and clean-up costs were obtained from damage survey reports from the 1995 and 1992 floods and directly from landowners and private business interviews. Flood damages were based on the results of the hydraulics and hydrology simulation modeling using HEC-2. The HEC-2 data routed the water for the storm events modeled (5,25 and 100 year storm events) establishing both floodplain perimeters as well as flood depths. This data was then used with water depth to damages functions provided by FEMA to estimate damages by storm event for both the future without project (FWOP) and future with project (FWP) alternatives scenarios.

These estimated damages formed the basis needed to construct damage frequency curves relating percent chance of storm occurrence with specific event damage estimates. The resulting functional relationships permits the prediction of damages for lessor and greater events than the storms of record and the simulated 5, 25 and 100 year storm events. An annualized estimate of storm damages from all storm events is the end result of this analysis. An additional estimate for annual flood damage avoidance expenditures made by private businesses in Buena Vista was added to the predicted annual damages to establish total average annual damages for both the FWOP and FWP alternatives.

All costs of installation, operation and maintenance were based on 1998 prices. The costs of all structural measures were assumed to be implemented over a five-year installation period and to have a 50-year useful life. Thus a 55 year period of analysis was used along with the mandated 7.125% discount rate for all federal water resource projects for FY98 to discount and amortize future costs and benefits.

Damage reduction benefits were determined by computing the difference in damages for the FWOP condition and the damages expected with each alternative in place. The basis for the assumptions concerning FWOP and FWP conditions are covered in the plan under "Effects of Alternative Plans".

APPENDIX D

PROJECT MAP

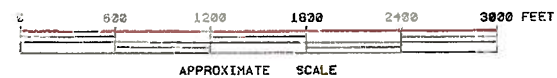


MAP LEGEND

- Bridge or Culvert Replaced
- Sediment Basin
- Channel Improvement
- Floodwall/Berm
- Concrete Channel (Planned by City)
- Bridge Replaced (Planned by VDOT)
- Benefitted Area



BUENA VISTA PROJECT MAP



CITY OF BUENA VISTA, VIRGINIA (INDEPENDENT CITY)	
U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	
Designed <u>A. KETCHUM</u>	Date <u>1/98</u>
Drawn <u>KETCHUM & BIDDIX</u>	Approved by _____
Traced <u>D. WILLIAMS</u>	Title _____
Checked _____	Sheet <u>2</u> of <u>12</u>