Chapter 4
AFFECTED ENVIRONMENT

Affected Environment—The environmental impact statement shall succinctly describe the area(s) to be affected or created by the alternatives under consideration. (40 CFR 1502.15).

The environment affected by the Emergency Watershed Protection Program is comprised of the portions of watersheds of the United States that have been impaired by natural disasters over the years to such an extent that life or property is threatened. The impaired conditions that trigger the EWP Program make it fundamentally different from most other Federal programs because other programs are usually undertaken in relatively undisturbed environmental conditions. This chapter describes the aquatic, floodplain, wetland, riparian, and upland ecosystems of the U.S. watersheds, focusing on characteristics that indicate their general condition or health. These characteristics are used to evaluate the effects of natural disasters and of the EWP Program. The chapter then describes the characteristics of human communities in U.S. watersheds, focusing on the rural communities most likely to be affected by EWP Program activities. The chapter briefly describes typical EWP practice sites, floodplain easement sites, selected human communities, and watersheds that are used as examples of the environmental consequences of the EWP Program in the impacts assessment in Chapter 5.

4.1 OVERVIEW OF THE AFFECTED ENVIRONMENT

The environment affected by the EWP Program consists of the portions of the watersheds of the U.S. states and territories that are associated with human uses, and communities where watershed impairments resulting from natural disasters may threaten life or property. Potentially affected watersheds include all of those of the 50 states and territories except coastal areas (including beaches, dunes, and coastlines) and Federal lands. Although EWP Program work can be performed in virtually any watershed location, a typical EWP Program restoration site is in the upper reaches of a relatively small watershed, in a rural area, or rural outskirts of an urban area. There are exceptions to this general rule, as in the case of the 1993 Upper Mississippi floods, when the EWP Program assisted in the recovery effort in many different ways, such as repairing mainstem river levees.

This PEIS addresses the impacts of the EWP Program on watershed aquatic, floodplain, wetland, and riparian ecosystems. It also addresses the impacts of certain practices, such as critical area treatment and upland debris removal, on watershed upland ecosystems. The analysis is based on the potential for both adverse and beneficial changes in the watershed ecosystems. The PEIS addresses the conditions of these ecosystems before a disaster, in the aftermath of a disaster, and after the EWP Program practice or floodplain easement is installed. It covers current EWP Program restoration practices and easements as well as proposed practices and easements.

The condition of aquatic habitats is characterized using EPA's bioassessment protocols based on aspects of in-stream habitat and channel morphology. Water quality and pollutants are also addressed in classifying habitats according to how well they support aquatic communities, including T&E species. Similar classifications are for the before-disaster, after-disaster, and after-EWP Program conditions of floodplain, wetland, riparian, and upland watershed ecosystems. The evaluation of impacts incorporates analyses of the environmental effects of Program practices at example project sites typical of EWP Program practices.

T&E species, their habitats, and areas designated by Habitat Conservation Plans (HCPs) are federally protected and site-specific in occurrence. They are addressed before implementation of every EWP project, and they are protected, as appropriate, on a case-by-case basis. They are not characterized, nor evaluated, species-by-species in the general programmatic impacts analysis. However, they are described as protected components of the affected environment for each of the example EWP sites and are discussed as sensitive biotic components of the affected ecosystems.

Aspects of human communities potentially affected by the EWP Program include the economic, social, cultural, and recreational resources. These aspects of rural communities nationwide are described, and then example communities where substantial EWP work has recently been carried out are also described. The selected rural outskirts, small towns, and rural agricultural locations typify the range of human communities where the EWP Program is called in to deal with threats to life and property.

Cultural resources are site-specific and community-specific resources that are addressed before implementation of every EWP project and protected, as appropriate, on a case-by-case basis. They are not characterized programmatically, nor evaluated, in the general programmatic impacts analysis. However, they are described as protected components of the affected environment for each of the example EWP sites.

The cumulative impacts of EWP Program projects and other watershed activities are described using selected minor watersheds (USGS 12-digit watersheds) and major watersheds (8-digit USGS hydrologic units).

Twenty-three individual practice or floodplain easement sites were selected in 14 watersheds (Table 4.1-1) to represent typical impairments and EWP Program practices. Of the locations (Fig. 4.1-1), 6 were chosen to represent the range of affected human communities, and 3 were selected to illustrate cumulative effects throughout the watershed.

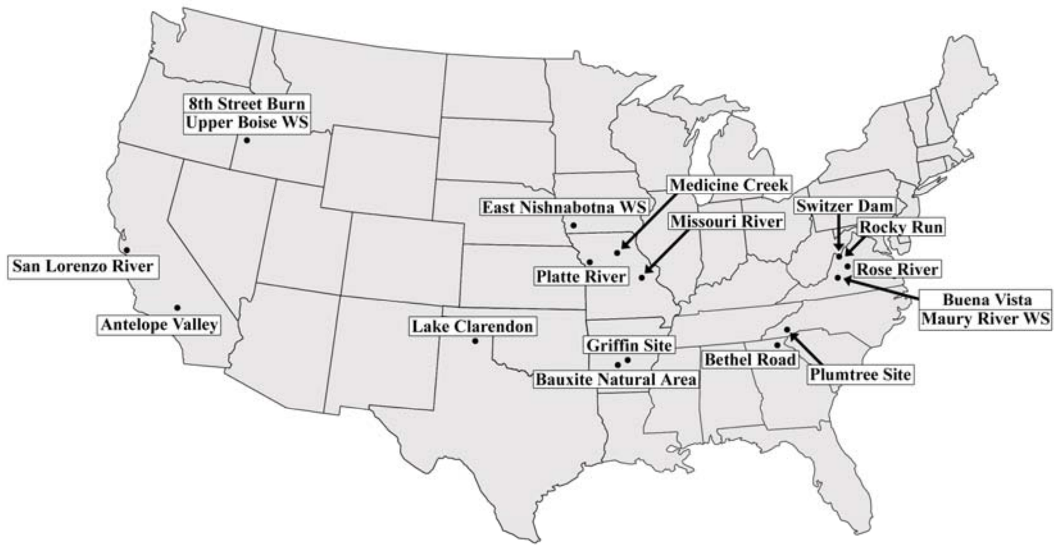


Fig. 4.1-1. Watershed Impairment Sites Used as Examples in the Analysis of EWP Program Impacts (WS = watersheds used in cumulative impacts analysis)

Table 4.1-1 Watersheds and Project Sites Where Potential Ecosystem, Human Community, and Cumulative Impacts are Addressed in the PEIS

8-digit Watershed (code)	Site(s)/Location	Restoration Practices or Easements	Affected Human Communities	Cumulative Impacts Affected Area
Lower Boise (17050114)	8th Street Burn, Boise Foothills north of Boise, ID	Critical Area Treatment of Major Burn Area in outskirts of Boise	Rural area in a metropolitan county	Lower Boise River Watershed, Ada Co., Region
Maury River (02080202)	Buena Vista, VA (small city on the Maury River)	Debris removal in 4 streams flowing through city	Independent city of Buena Vista in predominantly rural region	Buena Vista and Maury River Watersheds, Rockbridge County
	4 conservation practice locations in watershed, VA	Enduring conservation practices		
East Nishnabotna (10240003)	3 East Nishnabotna restoration sites, IA	Riverton Easement Debris, bank and levee damage on 3 sites on river and tributaries	Incorporated rural community of Shenandoah, IA and nearby farms	E. Nishnabotna Watershed, Fremont Co.

Table 4.1-1 (Continued) Watersheds and Project Sites Where Potential Ecosystem, Human Community, and Cumulative Impacts are Addressed in the PEIS

8-digit Watershed (code)	Site(s)/Location	Restoration Practices or Easements	Affected Human Communities	Cumulative Impacts Affected Area
East Nishnabotna (10240003)	Riverton Easement Site, IA	Floodplain easement near Riverton		E. Nishnabotna Watershed, Fremont Co.
Upper Chattahoochee River (03130001)	Bethel Road site, Hall Co., GA	Tornado debris in stream	Two small independent farms in a rural area	
South Fork Shenandoah (02070005)	Rocky Run Site, Rockingham Co., VA	Streambank Repair, Hypothetical Improved Lands Floodplain Easement	Residential cluster community of Rocky Run	
	Switzer Dam Site, Dry River, Rockingham Co., VA	Switzer Dam, Spillway damaged by Hurricane Fran		
Rapidan-Upper Rappahannock (02080103)	Rose River site, Criglersville, Madison Co., VA	Streambank Repair Site	Independent farm near small rural community	
Upper Saline (08040203)	Bauxite Natural Areas, AR	Tornado downed trees in sensitive habitat		
	Griffin site, Alexander, AR	Household and woody debris from tornado		
Antelope-Freemont Valleys (18090206)	Antelope Valley, CA	Drought with life-threatening sandstorms		
San Lorenzo-Soquel (18060001)	San Lorenzo River - Santa Cruz Co., CA	Soil-Bioengineering to protect streambanks		
Nolichucky River (06010108)	Plumtree, NC	Natural stream dynamics and bioengineering practices pilot project		
Upper Salt Fork Red (11120201)	Lake Clarendon Clarendon, TX	Sewage Treatment Plant on Floodplain		
Lower Missouri River (10300200)	Missouri River floodplain site, MO	Floodplain deposition site		
Lower Grand (10380103)	Medicine Creek site, MO	Floodplain easement with setback levee, Water control		
Platte River (10240012)	Platte River, MO	Floodplain easement, water control		

4.2 ECOSYSTEMS AFFECTED BY THE EWP PROGRAM

The primary objective of the EWP Program is to remove threats to life and property posed by sudden watershed impairments resulting from natural disasters. The environment affected by the EWP Program's restoration practices and easements is comprised of the watersheds of the U.S. states and territories where life and property are potentially at risk from natural disasters. This definition of the Program's affected environment is important in two respects. First, it includes virtually all U.S. watersheds with a few exceptions. Second, it focuses on where the natural environment intersects with human uses and communities. Natural disasters can, and do, alter watershed characteristics rapidly and radically. However, where there are no human uses or communities that would be affected by the sudden watershed impairment, there is no threat to human life or property, and the Program would not be involved.

Federal lands not managed by the USFS and coastal areas subject to ocean wave action, including along the Great Lakes, are the only watersheds not covered by the Program. These exceptions are generally the main stems of major rivers and the cities and towns on their riverbanks. Damages to these localities are routinely handled by the USACE and FEMA, although NRCS may be requested to assist when widespread Presidentially-declared disasters occur.

This chapter presents an overview of the natural environments of watersheds and of the human communities where disasters threaten life and property.

4.2.1 Watershed Characteristics

The dynamics of watersheds and their ecosystems are the subject of extensive research and management efforts by Federal, State, and local government agencies, academia, and environmental groups. The analysis of EWP Program impacts on watershed environments in this PEIS is based on current understanding of the principles of watershed science.

4.2.1.1 Watershed Identification

Hydrologic units (HU) comprise a hierarchical coding system developed by the U.S. Geological Survey that divides the United States and the Caribbean into 21 major resource regions (2-digit units), 222 sub regions (4-digit units), 352 accounting (6-digit) units, and 2,150 8-digit cataloguing units (Fig. 4.1-1). The 8-digit units delineate river basins with drainage areas usually greater than 700 square miles (USGS, 1999) and are the basis for the:

- Watershed health data compiled by EPA
- Prioritized watershed planning and management described for EWP Program Alternative 3
- Large watershed cumulative impacts analysis of this EWP PEIS (red arrows on Fig. 4.2-1).

Smaller (11-digit and smaller) watershed subunits and reaches of 8-digit hydrologic units are the context for the smaller watershed EWP Program cumulative impacts analyses.

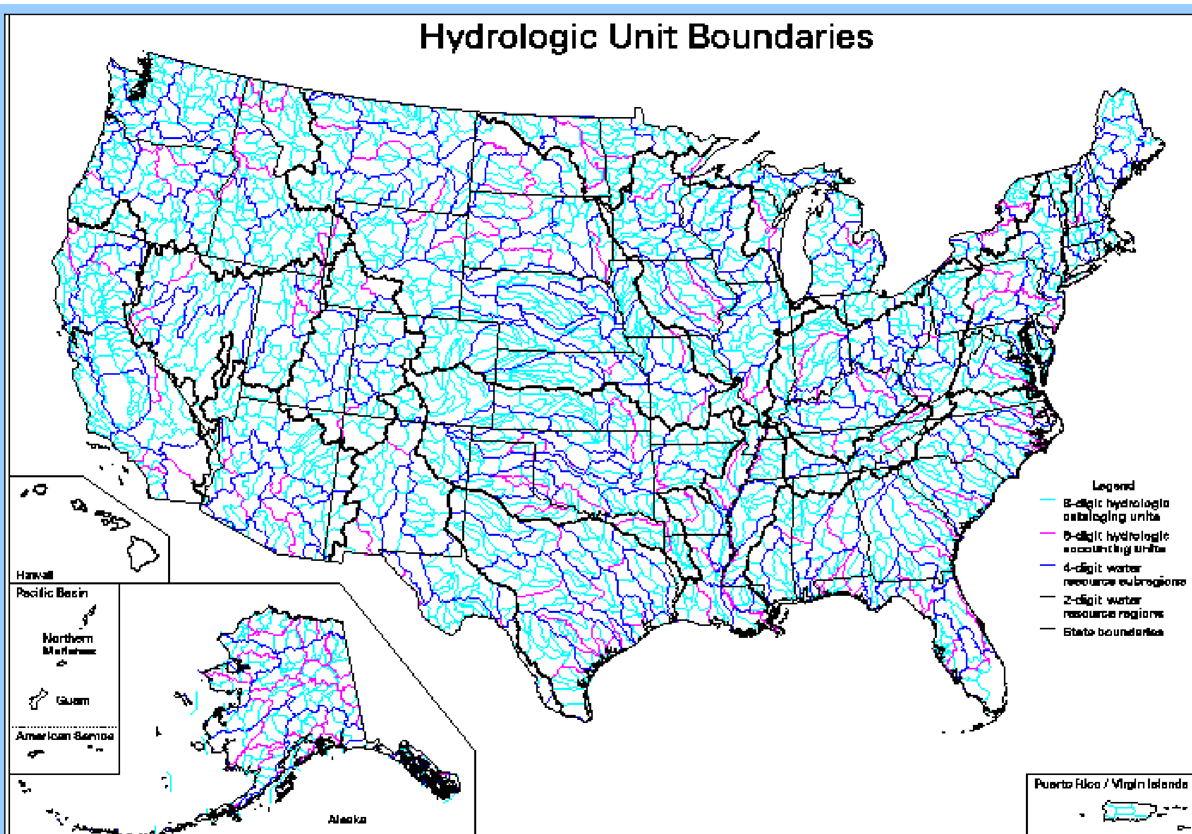


Fig. 4.2-1 U.S. Watersheds—Hydrologic Unit Boundaries based on the U.S. Geological Survey HUC System

4.2.1.2 Watershed Ecosystems

This section describes the important aspects of watershed aquatic, floodplain, wetland, and riparian ecosystems that potentially would be affected by the EWP current and proposed restoration practices. It describes important aspects of watershed upland ecosystems that might be affected by certain practices such as critical area treatment and upland debris removal.

4.2.1.2.1 Watershed Aquatic Ecosystems

For the purposes of the PEIS, the NRCS Interdisciplinary Team first considered the importance of the Program interactions of components of aquatic ecosystems that are affected by disasters with EWP Program practices. Then, the team adopted a categorization scheme to evaluate and describe Program impacts. It used an impacts network adapted from the methods of the NRCS (1977) and Sorenson (1971) as described in Canter (1996). EWP Program practice components generate impacts to and among living and non-living aquatic community components as diagrammed in Appendix B. These causal flow diagrams were reviewed and revised to ensure that all of the important components and their relationships were correctly specified. Questions were formulated to serve as comprehensive checklists for the review of the impacts analysis. To focus the PEIS analysis on potentially significant impacts and to ease the presentation for the reader, the NRCS Interdisciplinary Team classified aquatic ecosystems according to their condition (Table 4.2-1). This classification allows a concise treatment of the range of different aquatic environments potentially affected by the Program. The classification is based largely on the EPA *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish* (EPA, 1999e). It facilitates the discussions of the before-event conditions of aquatic ecosystems, how they are affected by disasters, how they are affected by EWP Program practices, and how the changes proposed under the Program alternatives would alter those effects.

4.2.1.2.2 Riparian, Wetland, and Floodplain Ecosystems

Floodplains, terraces, and other features of stream systems are formed primarily through erosion, transport, and deposition of sediment by stream flow. Near-stream areas provide much of the energy for stream systems by contributing coarse particulate organic matter (CPOM). As outlined previously, riparian and floodplain areas serve an integral role in a stream's production of energy, especially in lower order streams. Floodplains and riparian systems also aid in controlling the sediment and nutrient loads of a system. The vegetation in these areas filters runoff before it reaches the aquatic environment.

The team addressed these near-stream ecosystems in the same way it addressed aquatic ecosystems. First, the basic components of the ecosystems and their interrelationships were identified in flow diagrams (Appendix B) and linked to activity components of EWP Program practices, with questions then prepared. Then, condition classifications using important aspects of the ecosystems (Tables 4.2-2 to 4.2-4) were created to focus and simplify discussions. Condition parameters were chosen to reflect habitat values important to maintaining these environments and, as important, the role the environments play in determining the condition of the aquatic systems in their watershed and the effects of disasters on aquatic systems.

Table 4.2-1 Aquatic Ecosystems Condition Classes

Condition	Primary In-stream Habitat		
	***Epifaunal Substrate (Available Cover) High and Low Gradient**	***Embeddedness – High Gradient * Pool Substrate Characterization – Low Gradient**	***Velocity/Depth Regimes – High Gradient *Pool Variability – Low Gradient**
Optimal	Greater than 70% (50% for low gradient streams) of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	High Gradient - Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. Low Gradient – Mixture of substrate materials with gravel and firm sand prevalent; root mats and submerged vegetation common.	High Gradient – All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast shallow). (Slow is <0.3 m/s, deep is >0.5 m/s). Low Gradient – Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.
Suboptimal	40-70% (30-50% for low gradient streams) mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	High Gradient - Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment. Low Gradient – Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	High Gradient - Only 3 of 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes). Low Gradient – Majority if pools large-deep, very few shallow.
Marginal	20-40% (10-30% for low gradient streams) mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	High Gradient - Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. Low Gradient – All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	High Gradient – Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low). Low Gradient – Shallow pools much more prevalent than deep pools.
Poor	Less than 20% (10% for low gradient streams) stable habitat; lack of habitat is obvious; substrate unstable or lacking.	High Gradient - Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment. Low Gradient – Hard-pan clay bedrock; no root mat or submerged vegetation.	High Gradient – Dominated by 1 velocity/depth regime (usually slow-deep). Low Gradient – Majority of pools small-shallow or pools absent.

Table 4.2-1 (Continued) Aquatic Ecosystems Condition Classes

Condition	Channel Morphology		
	*Channel Alteration (High and Low Gradient)	*Sediment Deposition (High and Low Gradient)	*Frequency of Riffles (or Bends) – High Gradient *Channel Sinuosity – Low Gradient
Optimal	Channelization or dredging absent or minimal; stream with normal pattern.	Little or no enlargement of islands or point bars and less than 5% (<20% for low gradient streams) of the bottom affected by sediment deposition.	High Gradient - Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important. Low Gradient - The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)
Suboptimal	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% (20-50% for low gradient) of the bottom affected; slight deposition in pools.	High Gradient - Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15. Low Gradient - The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.
Marginal	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 30-50% (50-80% for low gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	High Gradient - Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. Low Gradient - The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.
Poor	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. In-stream habitat greatly altered or removed entirely.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	High Gradient - Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25. Low Gradient - Channel straight; waterway has been channelized for a long distance.

***Source**: Barbour, et al., 1999. *U.S. EPA Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish*. 2nd Edition. Office of Water, (EPA/841-B-99-002)

Table 4.2-1 (Continued) Aquatic Ecosystems Condition Classes

Condition	Water Quality			Pollutants	
	DO	Turbidity	Temperature (Examples presented for climates able to support low temperatures)	Contaminants (POLs/Metals)	Nutrients
Optimal	>7ppm	Low	Low, able to support salmonids, other cold water fish	Low – Very few occurrences	Low – moderate
Suboptimal	6-7ppm	Moderate	Moderately low, able to support some cool-water game fish	Low – Infrequent occurrences	Moderate
Marginal	4-6ppm	Moderately high	Moderate, able to support game fish	Low – more frequent occurrences	Moderate-high
Poor	<4ppm	High	High. Unable to support game fish	Frequent occurrences	High – eutrophic conditions

***Source:** Barbour, et al., 1999. *U.S. EPA Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish*. 2nd Edition. Office of Water, (EPA/841-B-99-002)

Table 4.2-1 (Continued) Aquatic Ecosystems Condition Classes

Condition	Biota			
	Macro-invertebrates	Resident Fish (Examples presented for streams able to support sensitive game fish species)	Higher Plants/ Algae	T&E Species/ Habitat
Optimal	Stoneflies, mayflies, caddisflies, present	Salmonids/Cool water game fish present	Little vegetation; uncluttered look to stream	Excellent supporting conditions
Suboptimal	Some mayflies, caddisflies, Dragonfly nymphs, beetle larvae, damselfly nymphs, clams present	Cool-water game fish present; high diversity (Walleye Pike, etc.)	Moderate amount of vegetation	Adequate supporting conditions present
Marginal	Some damselfly and dragonfly nymphs, beetle larvae present	Warm water game fish present; High diversity (Large mouth Bass, etc.)	Cluttered, weedy conditions; seasonal algal blooms	Conditions favorable for some T&E species
Poor	Aquatic worms, leeches, midge larvae present	Few or no game fish (Suckers, Catfish, Carp dominate)	Choked, weedy, or heavy algal blooms; dense masses of algae on bottom	Inadequate temperature food, habitat conditions to support T&E species

Table 4.2-2 Riparian Habitat Condition Classes

Conditions	*Bank Stability (High and Low Gradient)	*Bank Vegetative Protection (High and Low Gradient)	*Riparian Vegetative Zone Width (High and Low Gradient)
Optimal	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	More than 90% of the streambank surfaces and immediate riparian zones covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.
Suboptimal	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.
Marginal	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.
Poor	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.

*****Source: Barbour, et al., 1999. *U.S. EPA Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish*. 2nd Edition. Office of Water, (EPA/841-B-99-002)

Table 4.2-2 (Continued) Riparian Habitat Condition Classes

Conditions	Wildlife & Wildlife Habitat	T&E Species & T&E Species Habitat
Optimal	Diverse, high- density wildlife population and food source	Adequate food sources and habitat present to support T&E species, if present
Suboptimal	Moderate wildlife diversity; good habitat diversity; Adequate food sources	Moderate habitat and food sources available
Marginal	Moderately low wildlife diversity; lack of food sources to support higher-level wildlife populations	Lack of food sources to support T&E populations
Poor	Low wildlife diversity. Habitat unable to support wildlife populations (area affected by human activity, such as farming, urbanization, etc.)	Habitat unable to support T&E populations

Table 4.2-3 Wetland Condition Classes

Habitat Condition	Hydrology	Management	Vegetation
Optimal	Adequate storage for storm events; Slows peak velocities; allows for infiltration	No management needed to maintain quality OR is being managed continuously to maintain quality.	Diverse, dense. Provides an adequate nutrient filter.
Suboptimal	Adequate storage for storm events; Slows peak velocities; allows for infiltration	Little management needed to improve quality OR is being managed periodically to maintain quality.	Moderately Diverse. Adequately removes nutrients, pollutants from stormwater runoff.
Marginal	Minimally slows peak discharge	Moderate management needed to improve quality OR is being managed often to maintain quality.	Contains only a few species. Rather sparse; minimally aids in removing nutrients, etc.
Poor	Little or no ability to slow peak discharge	Substantial management would be needed to improve and maintain quality but is not being done.	Sparse. Does not provide a great deal of aid in removing nutrients, pathogens, etc.

Table 4.2-3 (Continued) Wetland Condition Classes

Habitat Condition	Habitat	Wildlife	T&E Species
Optimal	Diverse. Contains diverse vegetative and structural habitat.	Diverse. Adequate habitat and food sources available.	Habitat and food sources adequate to support T&E species.
Suboptimal	Moderately Diverse	Moderately Diverse. Adequate habitat and food sources available.	Habitat and food sources adequate to support T&E species.
Marginal	Less Diverse	Less Diverse. Habitat and food sources lacking for some organisms.	Habitat and food sources adequate to support only certain T&E species.
Poor	One dimensional	Habitat and food sources inadequate for many types of wildlife populations.	Habitat and food sources not adequate to support T&E species.

Table 4.2-4 Floodplain Condition Classes

Habitat Condition	Land Development & Uses	Hydrology	Vegetation
Optimal	Minimal development. Extensive timber or natural grasslands; low percentage of area is farmed; little to no impervious surface	Substantial storage for storm events; slows peak velocities; allows for substantial infiltration; little or no restriction of flood waters over floodplain	Diverse, dense. Provides an adequate nutrient filter
Suboptimal	Some development. Minor amount of impervious surface; substantial amount of natural cover; may have farming	Adequate storage for storm events; slows peak velocities; allows for moderate amount of infiltration	Moderately diverse. Adequately removes nutrients, pollutants from stormwater runoff
Marginal	Moderate development. Moderate area in impervious surfaces; may also have extensive farming	Minimally slows peak discharge. Restrictions on floodplain overflows along substantial portions of stream	Contains only a few species. Rather sparse; minimally aids in removing nutrients, etc.
Poor	Substantial development. Much area in impervious surface; farming may be moderate to major in importance	Minimally slows peak discharge. Major restrictions on floodwater flows over floodplain with levees, dikes, and dams	Sparse. Does not provide a great deal of aid in removing nutrients, pathogens, etc.

Table 4.2-4 (Continued) Floodplain Condition Classes

Habitat Condition	Habitat	Wildlife	T&E Species
Optimal	Diverse. Contains diverse vegetative and structural habitat.	Diverse. Adequate habitat and food sources available; native species abundant; exotic/invasive rare.	Habitat and food sources adequate to support T&E species.
Suboptimal	Moderately Diverse	Moderately Diverse. Adequate habitat and food sources available; native species common; exotic/invasive uncommon.	Habitat and food sources adequate to support T&E species.
Marginal	Less Diverse	Less Diverse. Habitat and food sources lacking for some organisms; native species uncommon; exotic/ invasive common.	Habitat and food sources adequate to support only certain T&E species.
Poor	One dimensional	Habitat and food sources inadequate for many types of wildlife populations; native species rare; exotic/invasive abundant.	Habitat and food sources not adequate to support T&E species.

4.2.1.2.3 Watershed Upland Ecosystems

As with aquatic, riparian, wetland, and floodplain ecosystems, the NRCS addressed the impacts of disasters and EWP Program practices on watershed uplands using the impacts flow diagram analysis and condition classification. (A flow diagram and question set are in Appendix B). The condition classification is presented in Table 4.2-5. Condition parameters were chosen to reflect habitat values important to maintenance of upland environments and, as important, the role uplands play in determining the condition of the aquatic systems in their watershed and in determining the effects of disasters on aquatic systems.

Table 4.2-5 Watershed Upland Condition Classes

Condition	Slope/ Stream Gradient	Soil Erosion Potential	Land Use/ Development	Vegetation	Wildlife	T&E Species
Optimal	Level to moderate	Low	Most land in natural cover	Extensive forest or native grass stands	Few or no introduced species; native wildlife relatively abundant	Good habitat to support presence and recovery
Suboptimal	Low gradient to moderately steep	Low to moderate	Substantial to moderate amount of land in natural cover	Substantial forest or native grass stands with corridor farming or development	A number of introduced species; native wildlife relatively common	Some habitat to support presence little to support recovery
Marginal	Low gradient to moderately steep	Moderate	Some natural cover; substantial land farmed or developed	Some forest or native grass stands in corridors with major farm or developed land	A number of introduced species; native wildlife relatively uncommon	Little habitat to support presence or recovery
Poor	Moderate to steep	Moderate to high	A high proportion of land farmed or developed or naturally damaged	Few or no forest or native grass stands or extensive invasive vine growth	Many introduced species; Native wildlife relatively rare.	Little habitat to support presence none to support recovery

4.2.1.3 Watershed Health

EPA provides in-depth data on national, regional and individual watershed health. The agency analyzed a series of data layers, which include indicators such as the number of aquatic species at risk, human population change, and drinking water quality. EPA uses 16 data layers (the Index of Watershed Indicators, or IWI) to formulate a single Overall Watershed Characterization—1 for a healthy watershed, and 6 for an imperiled watershed. These watershed indicators were used to characterize the health of EWP Program example watersheds in the analysis of cumulative impacts of the EWP Program. The 16 measurements (Table 4.2-6) characterize the condition (the current health of a watershed) and vulnerability (potential impact of future stressors, such as pollutants) of a watershed. Both condition and vulnerability are described as good, moderate, or poor, or the data on a watershed may be insufficient. Detailed descriptions of each measurement are from the EPA website and are available in Appendix D.

Table 4.2-6 Watershed Measurements Used to Characterize Watersheds

Watershed Measurement	Range of Ratings	Description of Ratings
Condition Indicators		
Designated Use	Critical, More Serious, Less Serious, Better	< 20%, 20-50%, 50-80%, 80-100% Meeting All Uses, Insufficient Assessment Coverage
Fish & Wildlife Consumption Advisories	More Serious, Less Serious, Better	Monitored with No Active Advisory, One or More Advisories—Limits Fish Consumption, One or More Advisories—No Fish Consumption, No Recorded Monitoring or Advisories
Source Water Indicators	More Serious, Less Serious, Better	No Significant Source Water Impairment Identified, Partial Impairment Identified, Significant Impairment Identified, Data Threshold Not Met
Contaminated Sediments	More Serious, Less Serious, Better	Inconclusive Data, Moderate Degree of Concern, High Degree of Concern, No Data for Assessment
Ambient Water Quality-Toxic Pollutants	More Serious, Less Serious, Better	0-10%, 11-50%, <50% Observations in Exceedance of Selected Reference Level, Data Sufficiency Threshold Not Met
Ambient Water Quality-Conventional Pollutants	More Serious, Less Serious, Better	0-10%, 11-50%, <50% Observations in Exceedance of Selected Reference Level, Data Sufficiency Threshold Not Met
Wetlands Loss Index	More Serious, Less Serious, Better	Low, Moderate, High Level of Wetland Loss, Insufficient Data
Vulnerability Indicators		
Aquatic/Wetland Species At Risk	High, Moderate, Low	1, 2-5, >5 Species Known to be At Risk, No Recorded Data
Pollutant Loads Discharged-Toxic Pollutants	High, Moderate, Low	No DMR Requirements for All Discharges, No Aggregate Loads in Excess of Total, Up To 20%, More Than 20%, Average Load Over Permitted Limits, Insufficient Data for >10% of Major Dischargers or >50% of Minor Dischargers
Pollutant Loads Discharged-Conventional Pollutants	High, Moderate, Low	No DMR Requirements for All Discharges, No Aggregate Loads in Excess of Total, Up To 40%, More Than 40%, Average Load Over Permitted Limits, Insufficient Data for >10% of Major Dischargers
Urban Runoff Potential	High, Moderate, Low	0-1%, 1-4%, >4% Land Area Above 25% Imperviousness, Insufficient Data
Agricultural Runoff	High, Moderate, Low	Low, Moderate, High Level of Potential Impact, Insufficient Data
Population Change	High, Moderate, Low	Declined/No Change, 0-7% Increase, >7% Increase, Insufficient Data
Hydrologic Modification By Dams	High, Moderate, Low	Low, Moderate, High Volumes of Impounded Water, Insufficient Data
Estuarine	High, Moderate, Low	Low, Moderate, High Susceptibility, Insufficient Data/Non-coastal Watershed

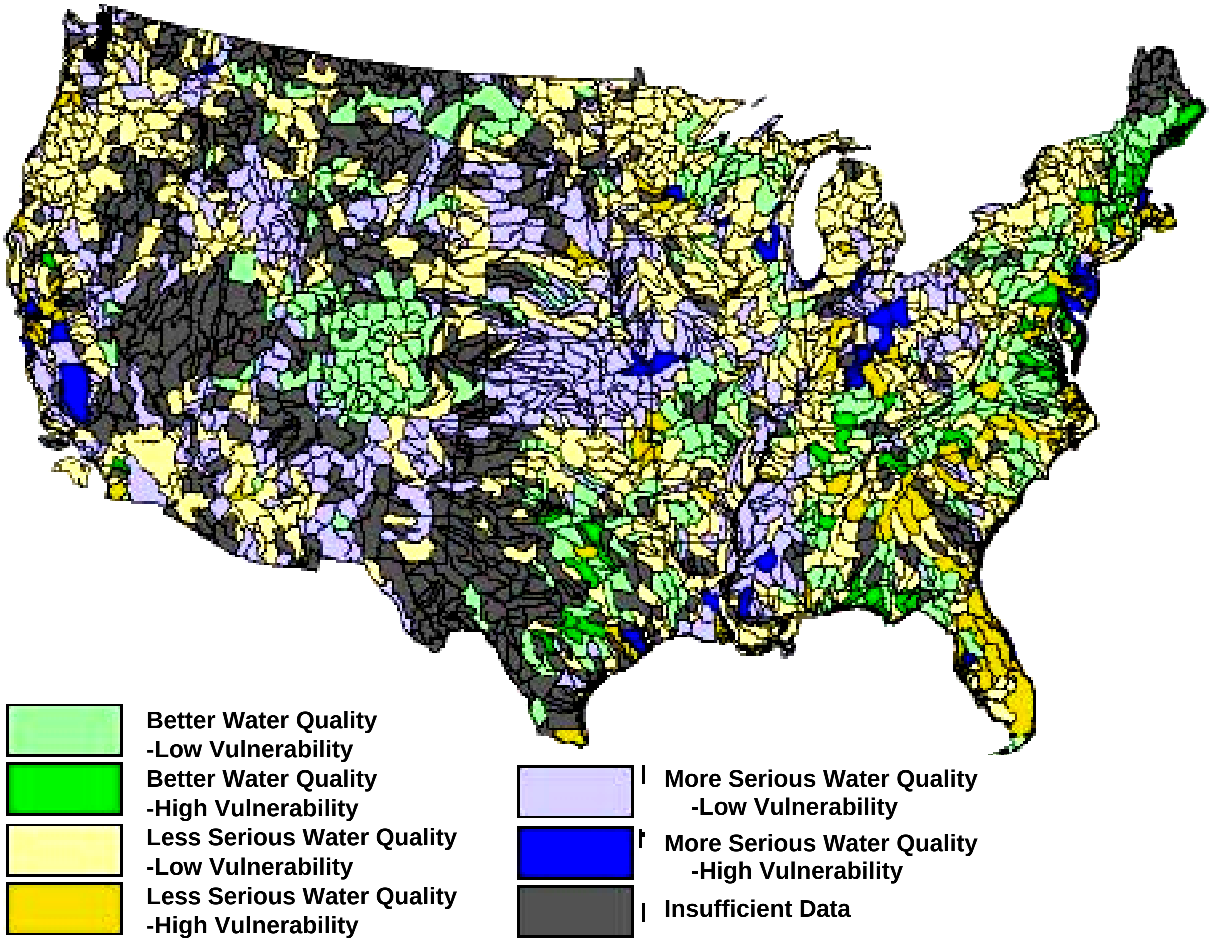


Fig. 4.2-2 EPA 8-digit HUC Watershed Ratings

EPA used a weighting methodology (see Appendix B) to construct the Overall Watershed characterization. The final product is a rating that accounts for 16 different variables, all of which indicate watershed health in a different way, summed into a single index of watershed health. This characterization resulted in six classes of watershed, with a seventh for insufficient data.

The classes, from healthy to imperiled watershed follow:

1. Watersheds with better water quality and lower vulnerability to stressors
2. Watersheds with better water quality and higher vulnerability to stressors
3. Watersheds with less serious water quality problems and lower vulnerability to stressors
4. Watersheds with less serious water quality problems and higher vulnerability to stressors
5. Watersheds with more serious water quality problems and lower vulnerability to stressors
6. Watersheds with more serious water quality problems and higher vulnerability to stressors
7. Watersheds for which insufficient data exists to assert condition or vulnerability

4.3 HUMAN COMMUNITIES AFFECTED BY THE EWP PROGRAM

The environment affected by the EWP Program includes those portions of the watersheds of the United States, including the 50 states and U.S. territories, associated with human communities or other human uses where life or property may be threatened by watershed impairments resulting from natural disasters. Natural disasters and their subsequent mitigation can affect a broad range of systems, structures, and activities within the human community. In addition to the immediate threat to human life and the potential for damage to land and associated property, natural disasters may have longer-term effects on the local or regional economy, infrastructure, the provision of social services to residents, or the structure, patterns, and quality of social life within a community.

The EWP Program can affect multiple aspects of a community and its social life. Immediately following a disaster (or where the threat of potential damage from a future disaster exists), a community's primary concern is to protect damaged infrastructure and housing, recover sources of employment and income, and to recover its economic structure (Vogel, 1999). Although the direct effect of EWP Program installed practices is to protect these vital elements of community life, the approach the Program takes in installing practices may also have important effects (both direct and indirect) on the community.

4.3.1 Characteristics of the Affected Environment

At the program-wide level, the affected environment is a generalization of the social characteristics of the communities addressed by the EWP program. Because most of the EWP Program practices are relatively small in scale, they directly affect a localized area, normally the size of a community. Indirect and cumulative effects, however, may extend to downstream communities as well. The human communities affected by the Program are also typically small and non-metropolitan in structure and social pattern.

Larger, metropolitan communities, which are normally associated with major transportation arteries such as main stem rivers, port facilities, and transportation routes, or with large commercial, production or administrative centers, are more likely to be addressed by FEMA or Army Corps of Engineers actions. These larger metropolitan communities are not typical of EWP Program activities. Furthermore, in these larger communities, the impacts of EWP activity in terms of potential effects on their economy, social fabric, and resources would invariably be "swamped" by the impacts of other economic, social, and related factors. Thus, substantial EWP impacts are extremely unlikely to occur.

4.3.2 Characteristics of Rural Communities

In contrast to metropolitan communities, rural areas are characterized by comparatively few people living in relatively large, less densely populated areas, with limited access to large cities, and a considerable travel distance to centers of employment or market activity (Hewitt, 1989). Rural government structures are generally smaller than their urban counterparts, and have smaller financial resources per capita to address problems (Reeder, 1990). In 1990, rural areas included 83 percent of the nation's land area, 21 percent of its population, 18 percent of its employment, and contributed 14 percent of the national income (ERS, 1995). Based on data from the 1990 Census, some 2,288 individual counties in the U.S. can be classified as rural.

Program activities may also affect neighboring metropolitan areas. These larger metropolitan areas, thus, must also be considered as part of the affected environment. Metropolitan counties are defined as whole counties containing all or part of a designated Metropolitan Statistical Area (MSA). MSAs must include at least one city with a population of 50,000 or more inhabitants or an urbanized area with a total population of 100,000, or 75,000 in New England (GAO, 1993).

The rural communities affected by the EWP Program will vary in terms of their predominant economic activity, land use pattern, social structure, and administrative organization. This diversity and variation can be explained by a number of factors. Among these are the natural land forms, the relationships between physical components of the land, the political, technological, economic and social history of the region, the availability of resources and needed services, and the racial, ethnic and cultural composition of the population (McLelland, et al., 1995).

Regional variations in income level, poverty, and the size, density, and structure of the population are also important. Variations among communities may also depend on the proximity of the community to larger urban centers and the degree of economic and social integration between these centers and the rural community (ERS, 1995; Hewitt, 1989; Cromartie and Swanson, 1996). As a result, the susceptibility of individual communities to the effects of a natural disaster, and the importance of EWP activity to the continued maintenance and future development of the community, will be unique in each circumstance.

Several other important characteristics of the rural communities potentially affected by the EWP Program are important to the analysis of impacts. In recent years, rural communities have undergone what is frequently characterized as an economic restructuring (Reeder, 1990). Where agriculture was once the dominant defining rural characteristic, a single industrial mode, residential configuration, or lifestyle no longer defines the socioeconomic patterns of contemporary rural communities. Communities remain strongly influenced by their predominant economic activity, but manufacturing and service industries are now more important sectors of the rural economy. Rural communities have also become more popular as tourist and recreational centers and as residential areas for retirees and families (ERS, 1995).

One result of this restructuring process has been an increasing difficulty in maintaining the current residential and employment base and the attraction of new residents or business investment to the community. These communities have also experienced a drop in per capita income during the past two decades. As Leistritz (1998) notes, this significant loss of purchasing power through out-migration (and a general decline in employment opportunity resulting from productivity increases in primary sector industries such as agriculture and manufacturing) have reduced the communities' ability to mobilize residents and resources to address critical problems.

4.3.3 Socioeconomic Factors Identified for the Affected Environment

Rural communities are characterized by social and lifestyle patterns distinctively different from their metropolitan counterparts. The predominately rural character of the communities in the PEIS indicates that in addition to population, employment and economic effects, factors such as community history and social characteristics may also be important in the identification of potential impacts. The social environment of rural communities includes important emphasis on a sense of place and community.

Specific socioeconomic factors that may be considered important in such an analysis (Burdge, 1995; ICGP, 1994; Leistritz, 1994) include:

- The structure of the local economy including existing employment levels, the dominant economic activity of the area, and the value of potentially affected property
- Community Resources, including the patterns of natural resource and land use, the availability of housing and other land for production or investment purposes, and future community development plans
- The demographic characteristics of the local community, including population size, and composition as well as any socioeconomically sensitive population clusters
- Community/institutional arrangements, including provision of necessary services, organization of local government, and linkages to external systems
- Individual and neighborhood level characteristics such as residential stability, age of the built environment, residential networks, level of identification with the community, and the presence of significant cultural or religious institutions

These variables are used to assess the potential for impact to the social environment from EWP programs and are grouped in four categories:

1. Effects on Economic Structure (Business and the Local Economy)
2. Effects on Infrastructure, Public Health and Safety, and Community Resources
3. Effects on Community Structure and Social Patterns
4. Environmental Justice considerations

Impacts are presented in Chapter 5. A summary description for each of the impact areas is provided in Table 4.3-1 below.

Table 4.3-1 Summary of Human Community Impact Areas

Community Aspect (Impact Area)	Description
Economic Structure	
Employment and Income	Critical to the continuing viability of a community and its residents, sources of employment and income include business and commercial establishments that employ local residents and provide necessary services and products to the community, as well as individual farms and related agricultural industry, recreational or other economically productive resources. These may be affected either by the threat of potential damage due to a natural event or by project related expenditures for protection or restoration following the event.
Value and Quantity of Natural Resources	Defined economically as the stock of environmentally provided assets (land, soil, forests, minerals, water, fauna, wetland areas, etc.), natural resources represent the useful materials that are the raw input or consumable products of human production. Quantity and condition of natural resources are both important. Both are a source of investment income to the current owner and future investment in the community from outside sources. These assets may be damaged either by the natural event itself or by implementation of the proposed EWP practice.
Infrastructure, Public Health and Safety, and Community Resources	
Infrastructure	The basic and essential elements that support the modern community (i.e. water supply, waste treatment, transportation, or power systems). The existing supply and current or future demand for infrastructure elements may be affected both by the consequences of a natural disaster or the requirements of the EWP proposed practices implemented in the community or in the surrounding region.
Property	Residential housing, other important economic or culturally significant buildings or other structures may be important to the quality of life in the community. In the event of a natural disaster, the utility, or setting of these structures may be damaged. Similarly, the implementation of EWP practices would be expected to have a beneficial effect, but may in some instances alter the desired characteristics of these structures.
Public Health and Safety, and other Community Resources	The range of public revenue supported and other valued resources that may be required to support and maintain the quality of social life of the community, community resources can include public health, safety, and emergency response, social assistance, and educational and cultural facilities, as well as recreation and aesthetic facilities and landscapes, and basic services such as shopping, food, entertainment, etc. Disruptions resulting from a natural disaster, from the requirement to expend resources for disaster recovery, or during the construction of EWP installed practices may impair the quality of life for community residents.
Social Pattern and Structure	
Population Characteristics	The size and composition of the local population and any indication of its stability, racial and ethnic composition, poverty and income levels, or residence patterns may serve to define the community or influence the community's response to the proposed practice or to a given program alternative.
Land Use	Existing and planned future uses of the land area available to the community and the potential aesthetic quality or suitability of the land for certain community uses. The protection of existing land uses may be critical to a community affected by a natural disaster, whereas a more pro-active land use and growth management policy supported by EWP program alternatives may prevent or diminish losses as an alternative to simply reacting to the crisis resulting from the effects of a disaster.
Social Pattern and Structure	
Community & Neighborhood Social Patterns	The sense of community and prevailing attachment to culturally valued places may be significantly affected both by the natural disaster itself and in the implementation of the proposed EWP practice. Also important is reliance within the affected community on clubs or informal groups that provide support to residents, either economically or socially. This may also include important facilities such as churches, schools, community centers, etc, as well as commercial and retail outlets for basic services.
Environmental Justice	
Impact Equity	Executive Order 12898 requires that federal programs, including the EWP program, determine whether a proposed alternative would have a disproportionate impact on socioeconomically deprived or minority populations in the affected community. Impact may result from the specific EWP activity itself, or may be the result of denying access to program benefits or information about the proposed practice or contracting opportunities that may arise during the construction phase of the program implementation.

4.3.4 Rural Community Types used in the Analysis

In order to describe the potential socioeconomic effects of EWP projects, five rural types have been extrapolated to illustrate the typical structures of EWP project communities. For each of the five types, a specific community was selected as an example for characterizing socioeconomic impacts in Chapter 5. Results of the analysis of example communities can be generalized to other communities of the same type, under similar circumstances.

The rural community types identified for the socioeconomic analysis include:

- Individual or multiple farms in less densely populated agricultural areas (not defined as a community itself, but considered as a part of the larger community for purposes of evaluating non-physical effects)
- Rural, unincorporated, enclaves in predominately metropolitan counties (may include either communities or individual properties)
- Residential housing clusters in areas defined as rural, with populations under 500
- Census defined places including unincorporated villages and small communities in non-farm areas with populations of less than 5,000
- Incorporated cities in areas defined as rural, with populations over 5,000.

Six communities where EWP projects have been undertaken recently were identified for analysis as examples for the impacts analysis. These communities were selected to reflect important characteristics associated with each community type while also representing a varied sampling of EWP installed practices. Three of the six communities are also presented as a part of the cumulative effects analysis. Because floodplain easements represent a categorically distinct option that would not be appropriate in all settings, a separate analysis was conducted for three of the communities where easements would be considered likely possibilities. Similar to the impact analysis, the results can be generalized to other communities under like situations. A summary of the socioeconomic characteristics of each of the six communities is presented in Table 4.3-2.

Table 4.3-2 Socioeconomic Characterization of the Six Communities Identified for In-depth Assessment

Community (1) Characteristic	Hall County, GA Bethel Rd., Community	Buena Vista City, VA	Boise, ID 8th St. Burn Area	Shenandoah IA Walnut Township Community	Rocky Run, VA	Rose River, VA
Community Type	Multiple Farms	Independent City in rural area	Rural portion of metro county	Incorporated rural community	Residential Cluster	Multiple Farms
EWP Practices	Debris Removal	Debris/ Cobble Removal	Critical Area Treatment	Levee Repair	Gabions & Rip-rap	Debris Removal

Table 4.3-2 (continued) Socioeconomic Characterization of the Six Communities Identified for In-depth Assessment

Community (1) / Characteristic	Hall County, GA Bethel Rd., Community	Buena Vista City, VA	Boise, ID 8th St. Burn Area	Shenandoah IA Walnut Township Community	Rocky Run, VA	Rose River, VA
Population size	2487	6406	14,579	1071	1181	5,672
Land Area (sq. mi.)	16.9	6.8	118.7	115.0	51.7	(1)
Rural population (%)	2487 (100%)	0.0	12.2	100	100%	100
Minority Composition (%)	19 (0.8%)	4.9	4.3	0.4	2.2%	13.6
Poverty (% at or below)	236 (9.7%)	14.4	6.5	14.2	10.3%	14.1
Per capita income	12198	$10,241	$22,200	$10,962	$11,088	$11,751
Total employment	1268	3149	7,764	474	658	2,660
Principal Economic Sectors	Service	Manufacturing, Trade, Construction	Trade, Services Manufrg.	Agriculture, Services, Trade	Manufrg, Trade Agriculture	Manufrg, Services, Trade
Housing – Median Year Constructed	1978	1957	1971	1939	1969	1966
Housing – Median value	$88,600	$43,300	$97,600	$32,500	$55,700	$70,200
Housing – Lived in same house since 1985	50.00%	62.6	47.0	73.0	71.7%	62%

Sources: U.S. Bureau of the Census: Census of Population and Housing, 1990, 1992 Economic Census, and 1992 Census of Agriculture

Notes:

(1) Represents the immediate community or a portion thereof that was directly affected by EWP action.

(2) Not determined for this community

4.4 WATERSHEDS EVALUATED FOR EWP CUMULATIVE IMPACTS

EWP Program practices carried out on sudden impairments in three example watersheds – the Buena Vista-Maury in Virginia, the Eighth Street Burn Area-Lower Boise in Idaho, and the East Nishnabotna in Iowa –were chosen for cumulative impact analysis (Table 4.4-1). They were selected because they illustrate the range of possible EWP Program practice and easement situations. Therefore, an intensive analysis for cumulative impacts was preferable to a more cursory examination of all 14 example-site watersheds. Buena Vista and Boise represented the use of Program practices in areas of potentially high interaction with a variety of land uses because of their urban settings and steep-slope environments. East Nishnabotna represented an almost totally agricultural land use context. (See Appendix D for a detailed description of each EWP practice site and the impacts of relevant disasters)

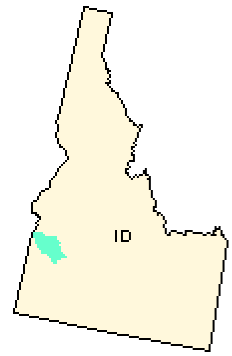
Table 4.4-1 Watersheds Evaluated for EWP Cumulative Impacts

Watershed (8-digit code)	Site(s)/Location	Restoration Practices or Easements	Affected Human Communities Analyzed	Cumulative Impacts Affected Area
Lower Boise (17050114)	8the Street Burn Boise Foothills north of Boise, ID	Critical Area Treatment of Major Burn Area in outskirts of Boise	Rural area located in a metropolitan county	Lower Boise River Watershed Ada Co.
Maury River (02080202)	Buena Vista, VA (small city on the Maury River)	Debris removal in 4 streams flowing through city	Independent city of Buena Vista in predominantly rural region	Buena Vista and Maury River Watersheds Rockbridge Co.
	4 conservation practice locations in watershed	Enduring conservation practices		
East Nishnabotna (10240003)	3 East Nishnabotna restoration sites, IA	Riverton Easement Debris, bank and levee damage on 3 sites on river and tributaries	Incorporated rural community of Shenandoah, IA and nearby farms	E. Nishnabotna Watershed Fremont Co.
	Riverton Easement Site, IA	Floodplain easement near Riverton		

In the Virginia and Idaho watersheds, both the immediate watersheds in which the EWP Program practices were carried out (USGS 12-digit watersheds) and the larger (8-digit) watersheds evaluated by EPA were considered relevant contexts for evaluation. The importance of setting watershed and resource boundaries in the cumulative impact analysis is discussed in Appendix B.

4.4.1 Boise, ID--8th Street Burn Area, Lower Boise River Watershed

4.4.1.1 Disaster Event



In the late summer of 1996, a wildfire burned 15,300 acres of the Boise foothills, severely impairing the area's ability to retard runoff. In the aftermath, it was estimated by the NRCS that little precipitation was needed to cause severe erosion and flooding in the floodplain within the City of Boise (BLM et al., 1996).

4.4.1.2 Site Description

The fire occurred in the region known as the Boise Front and was dubbed the "Eighth Street Burn". It contains approximately 15,300 acres of land in the Lower Boise watershed (HUC 17050114). Of that land, 4,180 acres is Bureau of Land Management (BLM) administered public land, 2,120 acres is state of Idaho land, 3,160 acres is Boise National Forest land, and the remaining 5,840 acres is split between private ownership and City of Boise and Ada County lands (BLM et al., 1996). A variety of EWP practices were installed in locations across the burned area to minimize the threat of severe erosion from subsequent rainfall events.

4.4.1.3 Human Community

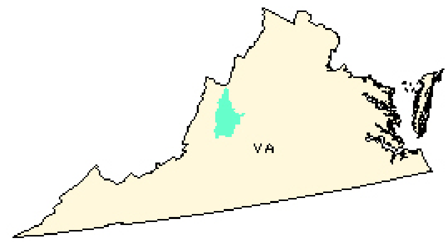
The Boise Hills community is essentially rural in character (approximately 77 percent of the total acreage), but is located in a predominately metropolitan county (Cook and Mizer, 1989). A substantial rural population is contained in the areas surrounding Hulls Gulch and Crane Creek. This portion of the affected community has a considerably lower population density than other portions of the Boise Hills community. Median property values and per capita income are also noticeably lower than for the more suburban areas. Land uses include low to medium density residential, rural agricultural, and open space. Some commercial/industrial and mixed uses are also present in suburban areas closer to the City of Boise.

The northern neighborhoods and the downtown corridor within Boise are expected to benefit from EWP activity. These sections of the City include a combination of residential, commercial and some industrial properties, as well as a number of structures important to the social life of the community that might be affected in the event of a flood. Median values for housing differ substantially between the city and the surrounding region and are greatly influenced by location (NRCS, 1996). Both the City of Boise and the area affected by the 8th St. Fire have a stable population base with over 40 percent of residents living in the same house for more than five years (Census, 1992).

The regional community represented by the Lower Boise Watershed has a population base of approximately 144, 836 and includes all of Canyon and Ada counties, plus small portions of Boise and Gem Counties. The regional economy is predominately farming and manufacturing based.

4.4.2 Buena Vista, VA--Maury River Watershed

The City of Buena Vista is located in eastern Rockbridge County between the east bank of the Maury River and the west slope of the Blue Ridge adjacent to the George Washington and Jefferson National Forests. Through these forests drain four streams, eventually reaching the Maury River after passing through Buena Vista. These streams (from north to south) are Chalk Mine Run, Indian Gap Run, Noels Run, and Pedlar Gap Run.



4.4.2.1 Disaster Event

Downpours resulting from Hurricane Fran in September 1996 caused considerable damage along the streams mentioned above. Debris clogged stream outlets, resulting in the flooding of several areas of the City. Severe erosion along streambanks also threatened many homes and businesses.

4.4.2.2 Buena Vista Small Watershed and Maury River Watershed

The watershed comprises 11,850 acres: 8,900 acres of forestland (most of which is in the George Washington and Jefferson National Forests), 2,850 acres of urban land, and 100 acres of grassland (there is no cropland in the watershed). Ownership of land in the watershed is 74.3 percent Federal, 24.2 percent private, and 1.5 percent City. There are no dams on these four streams. No wetlands or threatened and endangered species have been identified in the watershed.

The Buena Vista watershed is a sub-basin of the Maury River Watershed (USGS HUC 02080202), which originates about 40 miles north of Buena Vista on the eastern slopes of the Appalachian Mountains. The Maury River has a drainage area of 835 square miles, of which 649 square miles are above Buena Vista and 184 square miles are downstream of the City (Rockbridge County, 1996).

4.4.2.3 Enduring Conservation Practice Sites in the Maury Watershed

The four enduring conservation practices represented are: a diversion, a waste storage pond, an embankment pond, and a grassed waterway. Each of these sites is fully functional and has not failed during their lifespan, even in the heavy rains that caused the severe flooding in Buena Vista. Therefore, hypothetical failures have been analyzed with available information about the sites and the possible environmental effects (Flint, 1999).

4.4.2.3.1 Diversion Site

The diversion is found on the Goodbar farm just to the south of the town of Denmark. The area is moderately steep, as it is part of the downward slope from Big House Mountain to Kerr's Creek below. The diversion is located away from existing stream channels and protects the downslope croplands from overland flow of rainfall and subsequent erosion. The water is channeled into a waterway and routed around the croplands.

4.4.2.3.2 Animal Waste Storage Site

The waste storage pond is found on the Martin farm, to the north of the town of Fairfield. The waste from the dairy on-site is collected and dried within the pond before eventually being applied to agricultural fields. There is no outflow from the pond and no stream channels are located nearby, although intermittent portions of Marlbrook Creek are a quarter of a mile away.

4.4.2.3.3 Embankment Pond Site

An embankment pond is located on the Hickman farm, east of Horseshoe Bend in the Maury River. It is in an upslope area that drains into an unnamed intermittent stream and eventually into the Maury River approximately two miles below. It was built where two hills converge and serves to collect the runoff from each, preventing excessive runoff in the pasture and residences below.

4.4.2.3.4 Grassed Waterway Site

The grassed waterway site is found on the Moore farm to the southwest of the town of Raphine. The waterway routes runoff waters around agricultural land to prevent erosion. The grassy vegetation, a tall fescue, is used to slow flow velocities and prevent erosion of the waterway. The site drains into an unnamed tributary and eventually into Moore's Creek approximately a half mile downstream.

4.4.2.4 Human Community

Buena Vista is an incorporated, independent city, with a population of 6406 (Census, 1992). It is located in an area that is otherwise defined by its predominately rural character. The City of Buena Vista displays typical small community land uses that are primarily residential, with additional commercial and manufacturing sites evident throughout the City. There is a strong tendency toward residential stability, with over half of the residents living in the same house for more than 5 years. However, the city is also experiencing an overall decline in population estimated to result in a 7 percent decrease by the year 2010 (Census, 1997). A portion of its industrial base has been lost due to the effects of the national shift in economic production, but also due in part to the effects of the flood of 1985 (Buena Vista, 1999).

The County of Rockbridge, apart from the two independent cities of Buena Vista and Lexington, is almost completely rural by population. The economy of the county is non-specialized by industry type and is characterized by a significant population of workers (at least 40 percent) who commute to employment outside of the county (Cook and Mizer, 1989). This reflects a strong reliance on outside sources of employment for many of its residents.

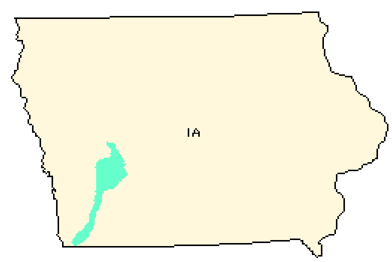
The regional area represented for the Maury Watershed includes all of Rockbridge County, as well as portions of Augusta and Bath Counties. The population of the region is approximately

34,576 persons. The specific portions of the counties that are contained by the watershed region are more rural in character, reflecting land uses that range from rural residential to more remote, sparsely populated agricultural areas and forested areas. Although the region is predominately rural in character, the primary economic activity is concentrated in wholesale and retail trade, manufacturing, and personal and professional services. Agricultural employment accounts for approximately 1,826 jobs, or 10.8 percent of the total regional employment.

4.4.3 East Nishnabotna River Watershed, IA

4.4.3.1 Disaster Event

The East Nishnabotna River originates between the towns of Manning and Templeton in Carroll County, Iowa. It flows south-southwest for 90 miles through Montgomery, Page, and Fremont counties to its confluence with the West Nishnabotna River, ten miles before they join the Missouri River. Heavy rains in 1998 resulted in flooding throughout both Freemont and Montgomery Counties. Streams and levees were impaired by the deluge in both counties.



4.4.3.2 Site Description

The East Nishnabotna River watershed has an area of 1,133 square miles. The river flows through a gently rolling portion of the Great Plains ecoregion, with nearly 100-150 feet of terrain relief from the river valley floors. The watershed is almost completely agricultural and crops occupy almost all of the land, except for some 11 percent that is covered by forest vegetation (EPA, 1999c). The watershed is not characterized as an urban one, although, several small cities are scattered throughout its area.

The appropriate watershed for cumulative impact analysis in this case was the entire East Nishnabotna River (8-digit HUC) watershed, since the EWP practices under analysis were performed on the main stem of the river itself. Particular attention was given to the specific reaches of the river on which the EWP practices took place, as well as actions affecting the river floodplain in the reaches above and below the EWP practices.

4.4.3.3 Human Community

Located near the southeast border of Walnut Township in Fremont County, the site of the EWP levee repair practice is an unincorporated rural community with a population of 1,071 persons (Census, 1992). The community is almost entirely rural, however, portions of the affected area lie near Shenandoah City. The city extends across the border from Page County into Fremont County. This area includes retail and commercial facilities (shops, hotel, airport, and entertainment), as well as some individual residences that would be affected, at least indirectly, by potential flooding in the East Nishnabotna area. Land uses are predominately agricultural with some commercial and residential areas represented in the cities.

Fremont County is classified as a completely rural county with an economy predominately influenced by agriculture. Page County, with a larger urbanized population, is characterized by a non-specialized economy (Cook and Mizer, 1989). Although manufacturing and trade represent the dominant sectors of employment, much of this economy is agriculture dependent. Housing in the immediate vicinity of the affected community and the two surrounding counties is generally older, with more than half of the units having been constructed prior to 1950. The area population is very stable with more than 60 percent of residents living in the same house for more than five years. However, both Fremont and Page Counties have also experienced a slight decline in population during the past decade.

The East Nishnabotna watershed regional area includes portions of Fremont, Page, and Montgomery Counties. The defined region contains a population of approximately 20,424. Reflecting the influence of the more urbanized areas of Montgomery County that are included in the region, somewhat less than half of the regional population (42 percent) is rural by residence.

4.4.3.4 Riverton Easement Site

The Riverton floodplain easement site is located just to the east of the town of Riverton, Iowa, along the East Nishnabotna River. The tract is approximately 655 acres of lowland and subsequently must be protected by levees. Historically, the land has been exclusively in crops but has faced levee breaches on the order of every three years, causing the landowner to spend more that a quarter of a million dollars in repairs in addition to substantial NRCS expenditures (Hanson, 1999).

Due to the repeated damage to the property, the site was a good candidate for the easement program. The property retains water each spring because it is lower in elevation than the surrounding area, so it will be restored as a wetland. There is an existing forested wetland on the northern portion of the property along the river. Runoff from the town of Riverton also contributes to the wet conditions (Hanson, 1999). Once the easement is purchased, the land will be sold to the Iowa Department of Natural Resources via a third party organization to assist in the transfer. The easement will then become part of the Riverton State Game Management Area, a large reserve with several hundred acres of wetland just upstream on the opposite bank. The contiguous area of managed lands will create a large floodplain area and substantial habitat for migratory waterfowl and other species, such as reptiles, amphibians, songbirds, and some fish (Priebe, 1999).

4.5 OTHER RURAL COMMUNITIES EVALUATED FOR EWP PROJECT IMPACTS

In addition to the human communities analyzed for EWP impacts in the preceding cumulative impacts watersheds, three other communities (Table 4.5-1) were evaluated in Georgia and Virginia. Rose River, Switzer Dam, and Bethel Road are highlighted in Table 4.5.1 below. Detailed statistics for selected characteristics of the affected environment at the immediate site and county levels are presented in Appendix D below.

Table 4.5-1 Other Communities Evaluated for EWP Program Impacts

8-digit Watershed (code)	Site(s)/Location	Restoration Practices or Easements	Affected Human Communities Analyzed
Upper Chattahoochee River (03130001)	Bethel Road site, Hall Co., GA	Tornado debris in stream	Two small independent farms in a rural area
South Fork Shenandoah (02070005)	Rocky Run Site Rockingham Co., VA	Streambank Repair, Hypothetical Improved Lands Floodplain Easement	Residential cluster community of Rocky Run
Rapidan-Upper Rappahannock (02080103)	Rose River site, Criglersville, Madison Co., VA	Streambank Repair Site	Independent farm near small rural community

4.5.1 Bethel Road - Hall County, GA--Debris Removal Site

Hall County is located in northeastern Georgia and lies in the foothills of the Blue Ridge Mountains. The predominant geographic feature in this moderately hilly area is the Chattahoochee River.

4.5.1.1 Disaster Event

Tornadoes destroyed homes and caused widespread damage in the forested watersheds when they struck in 1998.

4.5.1.2 Site Description

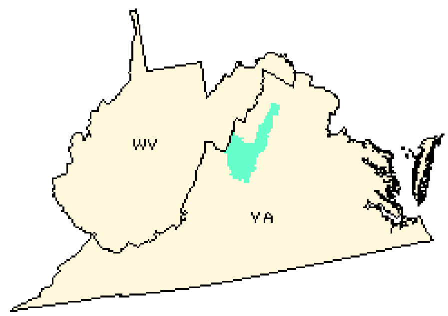
The land area is just over 80 percent rural in character. Although significantly rural, the county is also the regional center of northeast Georgia for shopping, medical services, and education. It is made up of 6 incorporated cities important for manufacturing, retail, and agriculture.

4.5.1.3 Human Community

The Bethel Road site is located in a less densely populated area of Hall County that is almost entirely rural in character. The EWP site itself represents an example of multiple farms in a less densely populated agricultural area. The affected site includes two farms, associated structures, and two local roads (DSR 001-139). Defined by census block, the area contains a population of 2,487 persons, of which an estimated 131 are classified rural by residence (Census, 1992). Minorities represent less than 1 percent of the population of the community in contrast to Hall County as a whole, which is just less than 15 percent minority.

An estimated 1268 residents were employed during 1990, with the service sector representing the primary source of income. However, manufacturing represents the largest single sector of employment accounting for 27.4 percent of all jobs. Agriculture-related employment accounted for 4.9 percent of the total. Of the 892 housing units in the community, 57.3 percent were built prior to 1980. The median year for house construction is 1978 as compared with 1975 for the county as a whole. Over 50 percent of the population has lived in the same house for over 5 years, indicating a degree of residential stability that is reflected in both the Bethel Road community and in surrounding Hall County, as well. The median value of housing in the Bethel Road community in 1990 was $88,600, slightly higher than that for the county. Approximately 10 percent of the residents of both the Bethel Road community and the county as a whole are living at, or below, the poverty level.

4.5.2 Rocky Run, VA



Rocky Run is a stream located in Rockingham County, Virginia and is a tributary of the Dry River. Flow in the lower reaches of Rocky Run ceases during dry periods, but pools with fish remain.

4.5.2.1 Disaster Event

The stream channel originally meandered through a residential development, but was redirected by landowners years ago. The redirected channel, which wraps around 15 homes, contains several 90-degree bends that have blown out during storm events.

In 1992, stormflows eroded banks and deposited large amounts of cobble and debris in the floodplain. Eleven homes were threatened by the destabilized system.

Riprap and gabions were placed on streambanks to stabilize the channel and to protect life and property from future damage. However, in September 1996, heavy rains from Hurricane Fran swelled Rocky Run and the existing practices protecting the community failed. Rather than following the constructed channel, the stream overflowed its banks and created a new channel, which cut directly through the residential areas and emptied into the Dry River. Five homes were flooded and others endangered, while large volumes of cobble and woody debris were deposited in the floodplain.

4.5.2.2 Human Community

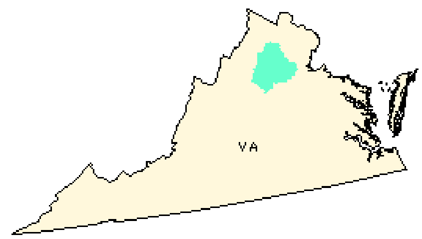
The community directly protected by the EWP practice at the Rocky Run site consists of 15 single-family dwellings and associated service buildings. This is an example of a residential cluster located in an unincorporated rural area. Estimated on the basis of average household size for the census block group containing the site, the population of the Rocky Run community is approximately 42 persons. The community is located in Rockingham County. The county is classified by ERS typology as having a non-specialized economy with the Federal Government representing a substantial source of income to residents (Cook and Mizer, 1989).

The community immediately surrounding the Rocky Run site is defined by census block and has a population of 1,181. Minorities comprise approximately 2.2 percent of the total population, a substantially lower figure than that for the State of Virginia, which is approximately 22.5 percent minority. A total 658 residents were employed in 1990. Manufacturing represented the single largest sector of employment accounting for 27 percent of all jobs, followed by retail and agriculture. Of the 479 housing units located in the larger community surrounding Rocky Run, 78 percent were built prior to 1980. The median year for unit construction for both the Rocky Run community and the surrounding county was 1969. The median value of owner occupied units in the community defined by the census block was $55,700, a figure comparable to that for the houses in the immediately affected area at the Rocky Run site (DSR RC-01), but significantly lower than the State median of $90,400. Approximately half of the residents have lived in the same house since 1970, indicating a very stable residence pattern for the site area and surrounding community.

4.5.3 Rose River – Madison County, VA

The Rose River site is located in Madison County just up-stream from the town of Criglersville. At its headwaters, the Rose River is a high gradient stream that supports naturally reproducing brook trout.

4.5.3.1 Disaster Event



This area had 4 major flood events from June 1995 to December 1996. Floodwaters from these large storm events led to severe erosion, channel movement, and the heavy deposition of cobble and woody debris. The homeowner's access road was threatened, as well as some other features on the property. EWP stream restoration practices, including rock weirs, riprap, rootwads, and vegetative techniques were used to repair and protect the disturbed area.

4.5.3.2 Site Description

The floodplain surrounding the EWP site is nearly void of vegetation from heavy grazing and the disruptive floodwaters. Several marginal wetlands are located downstream of the project area, which most likely would have been inundated with sediment if the EWP work had not been completed.

4.5.3.3 Human Community

Located in an almost completely rural county, the site immediately affected by EWP practices is a sparsely populated, agricultural area that includes at least two single-family dwellings, farm buildings, other structures, and pasture land (DSR MA-200). Near the site lie multiple farms in a less densely populated agricultural area. The area immediately surrounding the site is defined by census tract and contains a population of 5,672 persons (Census, 1992). Of these, an estimated 78 households (209 persons) are classified rural by residence. Manufacturing represents the single largest sector of employment accounting for 21 percent, while agriculture accounted for 8.3 percent of the total. Of the 2301 housing units located in the tract, 69 percent were built prior to 1980. Nearly half of the residents (46 percent) have lived in the same house since 1970. Sixty-two percent of the residences in the community have been occupied by the same householder for more than 5 years. This would indicate a stable residence pattern for the area surrounding the Rose River site.

Madison County, with a population of 11,949, is characterized by the ERS typology as having a nonspecialized economy that is commuter dependent (i.e., at least 40 percent of the workforce commutes to employment outside of the county) (Cook and Mizer, 1989). This would indicate a relatively small local economy. The median age and median values for housing in the county are similar to that for the Rose River tract. However, the county as a whole has a somewhat less stable population base, with only 38.3 percent of residents having lived in the same house for five years or more.

4.6 OTHER EWP PRACTICE & EASEMENT SITES EVALUATED

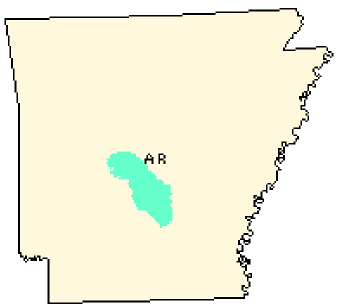
A number of additional example sites (Table 4.6-1) were included in the EWP analysis to address the effects of specific EWP practices or purchase of easements. See Appendix D for detailed site and disaster descriptions of the additional sites.

Table 4.6-1 Additional EWP Restoration and Easements Sites

8-digit Watershed (code)	Site(s)/Location	Restoration Practices or Easements
Upper Saline (08040203)	Bauxite Natural Areas AR	Debris Removal--Tornado downed trees in sensitive habitat
	Griffin site, Alexander, AR	Debris Removal-Household and woody debris from tornado
Antelope-Freemont Valleys (18090206)	Antelope Valley, CA	Critical Area Treatment --Drought with life-threatening sandstorms
San Lorenzo-Soquel (18060001)	San Lorenzo River site Santa Cruz Co., CA	Soil-Bioengineering to protect streambanks
Lower Grand (10380103)	Medicine Creek site, MO	Floodplain easement with setback levee
Lower Missouri River (10300200)	Missouri River floodplain deposition site, St. Charles Co., MO	Floodplain deposition removal/ disposal
Platte River (10240012)	Platte River, MO	Floodplain easement
Nolichucky River (06010108)	Plumtree, NC	Natural stream dynamics and bioengineering practices pilot project
Upper Salt Fork Red (11120201)	Lake Clarendon Clarendon, TX	Sewage Treatment Plant on Floodplain
Rapidan-Upper Rappahannock (02070005)	Switzer Dam Site, Dry River, Rockingham County, VA	Switzer Dam, Spillway damaged by Hurricane Fran

4.6.1 Bauxite Natural Areas, AR, Upland Disaster Debris

The Alcoa Corporation manages bauxite mining in central Arkansas in the vicinity of the towns of Benton, Bryant, and Bauxite, all southwest of Little Rock. In 1996, Alcoa entered into an agreement with The Nature Conservancy (TNC) to implement conservation and ecological management on 1,400 acres of land within the Bauxite Natural Areas on Alcoa lands. The region is home to several rare ecological communities and contains several federally listed species (TNC, 1998).



In March 1997, tornados ravaged central Arkansas and swept through the Alcoa/TNC managed area. The tornado was classified as an F4, with winds exceeding 200 miles per hour. An estimated 500 acres of woodlands were damaged and woody debris was widespread. Much of the debris was gathered into brush piles. The piles resulted in a threat to the rare herbaceous species and an increased danger of wildfire due to the ready supply of fuel. Invasive species (kudzu and Japanese honeysuckle) also posed a threat to plant communities (TNC, 1998).

TNC acted in place of NRCS for this EWP project and drafted a plan to remove the debris and reduce the threats in the most environmentally sensitive manner possible. TNC staff and volunteers executed a series of prescribed burns and a large amount of hand clearing over an area of 265 acres. Follow-up monitoring has shown very positive results, as T&E species are thriving, exotic species have been suppressed, and re-growth is progressing (TNC, 1998).

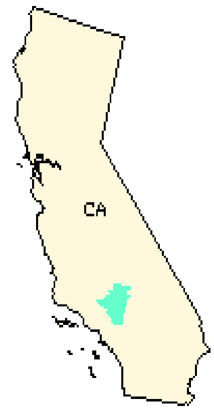
4.6.2 Griffin Site Alexander, AR, Tornado Household Debris Site

This site is in the same watershed as the previous site. The 5-acre plot near Alexander, Arkansas is privately owned and is a single dwelling residential plot. The land is heavily wooded.

Tornados struck in March 1997, and many households were damaged. The NRCS Chief granted an exemption from the EWP regulations that prohibit such work for NRCS to assist with the recovery from the tornado. At the Griffin site, there were approximately four acres of heavy woody debris, as well as a significant amount of household debris, such as construction materials (fiberglass insulation, shingles, etc) and personal belongings. Additionally, there was a danger to human health, as the debris piles can harbor rats, mosquitoes, and other disease vectors.

The EWP practice consisted principally of woody and household debris removal. Most debris was transported off-site to a landfill and burned. There was no on-site burning due to the close proximity of an airport. Additionally, the project area was re-vegetated and mulched.

4.6.3 Antelope Valley, Los Angeles Co., CA, Critical Area Treatment Site



The Antelope Valley site is a broad, low relief area in southern California north of the City of Los Angeles. Consisting of approximately 7,700 acres of abandoned desert farmland, the site had little remaining vegetation and is regularly subjected to high winds. Successive droughts in the late 1980s resulted in desert conditions within the region.

The site is located less than a mile from Antelope Acres, a residential development of approximately 350 homes. Numerous problems from the high winds, including multi-vehicle accidents, reductions in air quality, and sight reductions during aircraft landings at Edwards Air force Base, have occurred. The lack of vegetative cover and high wind conditions have led to a high volume of topsoil being eroded and the necessity to re-vegetate the area and enact soil management techniques to minimize future wind-erosion losses.

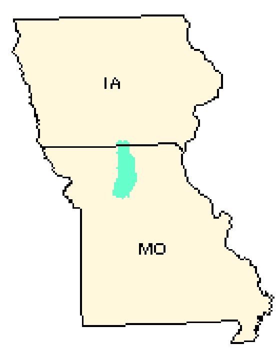
EWP practices that were utilized to combat the erosion conditions included aerial seeding, installing sand fences, seed drilling, furrowing, and tumbleweed disposal.

4.6.4 San Lorenzo River, Santa Cruz Co., CA, Soil Bioengineering Site

The California soil bioengineering site is located on the banks of the San Lorenzo River, near the community of Glen Arbor, in Santa Cruz County. A rainstorm on February 3rd, 1998 caused severe bank erosion spanning 450 feet on one side of the channel. It endangered 6 homes, while a landslide on the opposite bank endangered roads and businesses.

The EWP repair work involved the removal of debris from the channel, bank restoration with large riprap, and the revegetation of both banks.

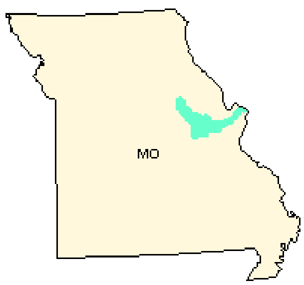
4.6.5 Medicine Creek Site, MO, Floodplain Easement & Setback Levee



The Medicine Creek site is a tract of 517 acres located in Livingston County in northern Missouri. The property is just southwest of the town of Wheeling and is located between Medicine Creek and Muddy Creek, approximately 2.5 miles north of their convergence before they empty into the Grand River. The site, previously used for intensive cropping by tenant farmers, falls within the historical floodplain for both creeks and is subject to frequent flooding—seven floods in the last 10 to 12 years (Young, 1999).

In 1993 and 1995, the levees protecting the site were breached. Subsequent repairs were then made. Under the EWP Floodplain Easement Program, the landowner was offered an easement allowing for the construction of a setback levee. The newly created floodplain would then be restored as a managed wetland using water control structures and ditch plugs to maintain wet conditions and a limited amount of vegetative planting (Young, 1999).

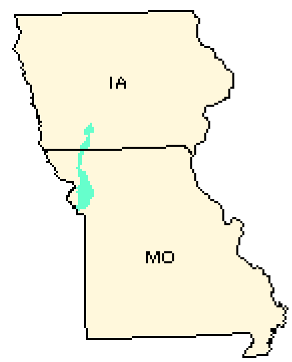
4.6.6 Missouri River Floodplain Deposition Site



During the floods of 1993, the Missouri River carried heavy sediment loads, depositing large volumes of sand and silt in floodplain areas. The EWP site in St. Charles County, located to the west of St. Louis, Missouri, in the Lower Missouri watershed (HUC 10300200) suffered a levee break. Cropland was subsequently buried under a layer of sediment several feet thick, rendering the land impossible to farm. Deep plowing was used to reclaim these farmlands, with large equipment plowing 4 to 5 feet into the earth to bring the land back into production (Cook, 1999).

4.6.7 Platte River Floodplain Easement Site

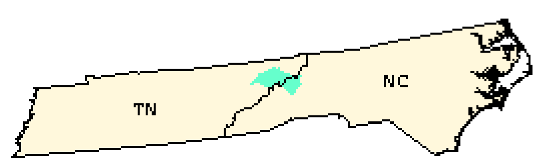
The Platte River floodplain easement site is located in western Missouri, north of Kansas City at the confluence of the Platte River (HUC 10240012) and the Little Platte River. The easement property is greater than 100 acres and the historical use of the property is agricultural, primarily tenant farming. Flooding is very frequent in this area, with 3 to 4 short duration floods per year in the spring (Berka, 1999). Traditionally, maintaining the levee at this site has been difficult (Howard, 1999).



During the rains leading to the 1995 flooding, a breach formed along the Platte River portion of the privately constructed levee on the northern edge of the property. Existing crops were lost and damage to the levee was substantial. NRCS determined that the levee repairs would only protect one landowner and were therefore not eligible for EWP repair funds. However, NRCS was able to offer a floodplain easement. The new floodplain resulting from this easement will be managed for the creation of wetlands (Berka, 1999).

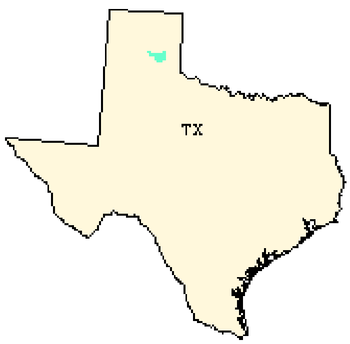
4.6.8 Plumtree NC, Debris and Streambank Damage Site

The Plumtree site is an approximately 9-mile section of the North Toe River in Avery County, North Carolina. The site is located north of the town of Plumtree and is bordered on the west by Doublehead Mountain and on the east by Mill Ridge and the Pisgah National Forest.



In 1998, heavy rain, in excess of 17 inches, caused flooding and debris blockage in portions of the North Toe River. Under the EWP Program, rock, woody debris, and trash were removed from the damaged portion of the river. The principles of natural stream dynamics were used to restore the stream profile, restoring eroding stream banks and improving trout habitat. The natural stream design included rock vanes, rootwads, log sills, point bars and re-vegetation. Materials needed to conduct the restoration were either gathered on-site or from Roaring Creek, located north of the site. A reference reach from the Toe River upstream of the site was used to best duplicate the natural stream structure.

4.6.9 Clarendon TX, Floodplain Structure Protection



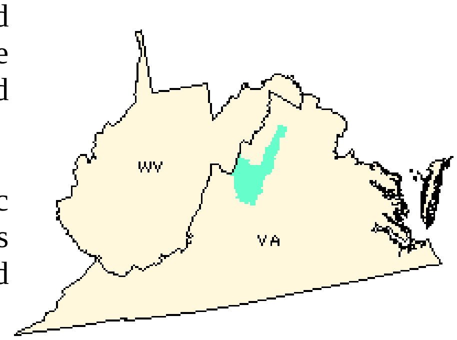
Clarendon is a town of approximately 2,000 located in the panhandle of northern Texas and is the county seat of Donley County. Just to the northeast of the city lies Clarendon Lake, a playa lake. Also located there is the municipal sewage plant, separated from the lake by a berm. Sewage is treated in holding ponds and then released into the lake.

The playa lake was rapidly filled after heavy rains struck the area in April 1997. Rainfall exceeded the 100-year rainfall event limits and the lake swelled to almost 10 times its normal area (Sears, 1999).

The EWP project used a diversion/berm to close off the plant and halt the flow of untreated sewage into the lake. This berm repair/diversion then allowed for the dewatering of the lagoon system and a return to normal operations.

4.6.10 Switzer Dam, Rockingham County, VA, Dam Spillway Repair

Flooding resulting from Hurricane Fran in September 1996 caused the destruction of two spillways on three dams located in the North River Watershed. The first earthen dam (Switzer Dam) is located at the confluence of Skidmore Fork and the Dry River Tributary. The second is located on the Dry River. The third dam is located on Dry Run, a tributary to the Dry River. The Dry River is a tributary to the North River, and the North River is a tributary to the South Fork Shenandoah River. All three dams suffered a high degree of erosion in their emergency spillways causing large amounts of sediment, cobble, and woody debris to be expelled into the Dry River. The damaged spillways caused an immediate threat to life and property should they fail and the dam suddenly breach.



The repair of the spillways involved excavating 2,100 cubic yards of storm deposited material; placing 6,000 cubic yards of fill in severely eroded areas; and grading, seeding, and fertilizing approximately 6 acres at the sites.