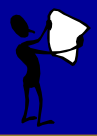

OTTAWA RIVER COALITION
Watershed-Based Plans Supported by the CWA Sec. 319 NPS Program
Barry Tonning, Tetra Tech


A watershed approach helps to...
1. Encourage Sound Science
2. Facilitate Communication and Partnerships
3. Provide Means of Cost-Effective Management
4. Focus on Environmental Results

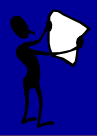
The Process:

Watershed Planning Steps



STEP 1
BUILD PARTNERSHIPS
- ID stakeholders
- ID issues of concern
- ID scope of effort & planning area
- Set preliminary goals
- Conduct outreach

Watershed Planning Steps



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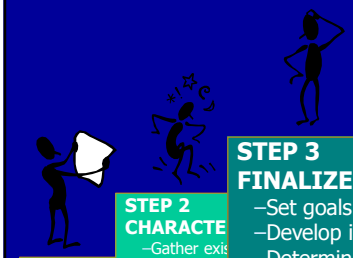
STEP 2
CHARACTERIZE WATERSHED
- –Gather existing data
- –Create data inventory
- –ID data gaps
- –Collect additional data, if needed
- –Analyze data
- –ID causes and sources
- –Estimate pollutant loads

Watershed Planning Steps



STEP 3
FINALIZE GOALS AND IDENTIFY SOLUTIONS
- –Set goals and management objectives
- –Develop indicators/targets
- –Determine load reductions needed
- –ID critical areas
- –ID management measures needed

STEP 2
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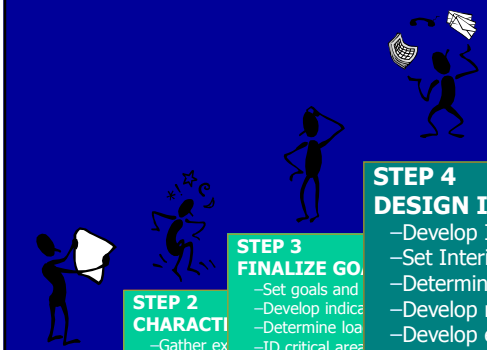
Watershed Planning Steps



STEP 4
DESIGN IMPLEMENTATION PROGRAM
- –Develop Implementation schedule
- –Set Interim milestones
- –Determine how you will measure success
- –Develop monitoring component
- –Develop evaluation process
- –ID technical and financial assistance needed
- –Assign responsibility

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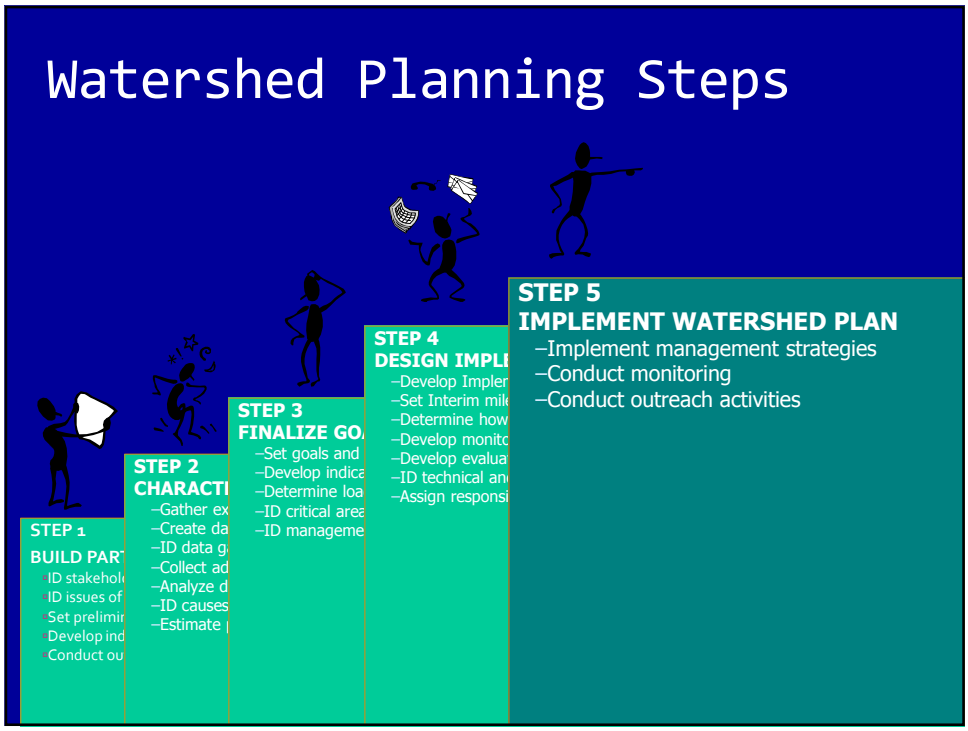
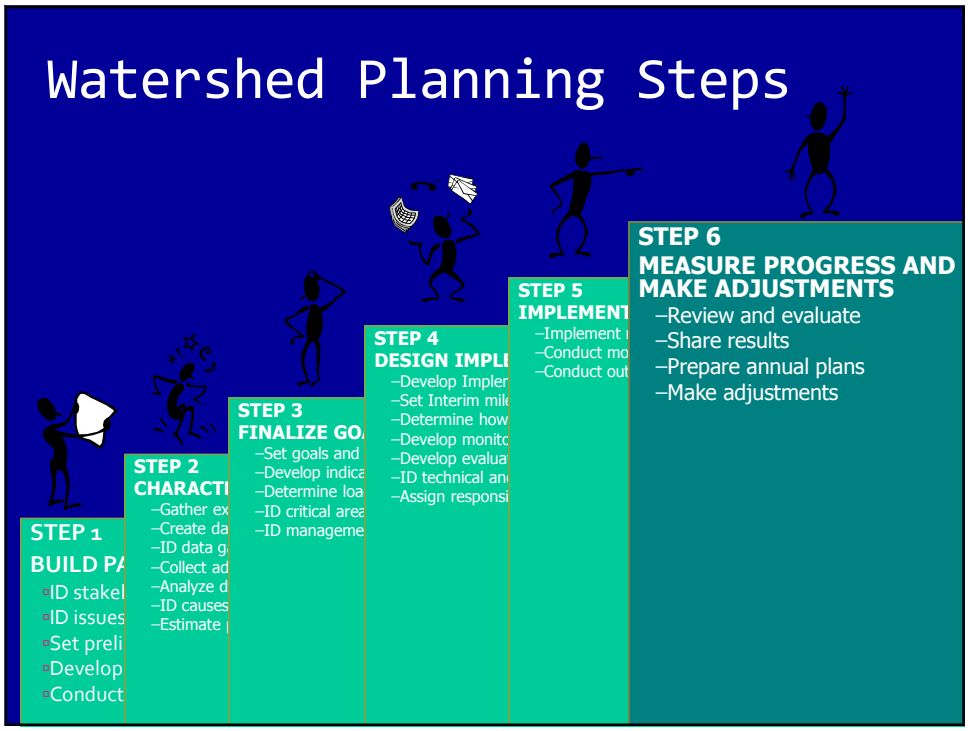

Watershed Planning Steps
STEP 5
IMPLEMENT WATERSHED PLAN
–Implement management strategies
–Conduct monitoring
–Conduct outreach activities
STEP 4
STEP 3
STEP 2
STEP 1


Watershed Planning Steps
STEP 6
MEASURE PROGRESS AND
MAKE ADJUSTMENTS
–Review and evaluate
–Share results
–Prepare annual plans
–Make adjustments
STEP 5
STEP 4
STEP 3
STEP 2
STEP 1

EPA's Nonpoint Source Funding Guidelines

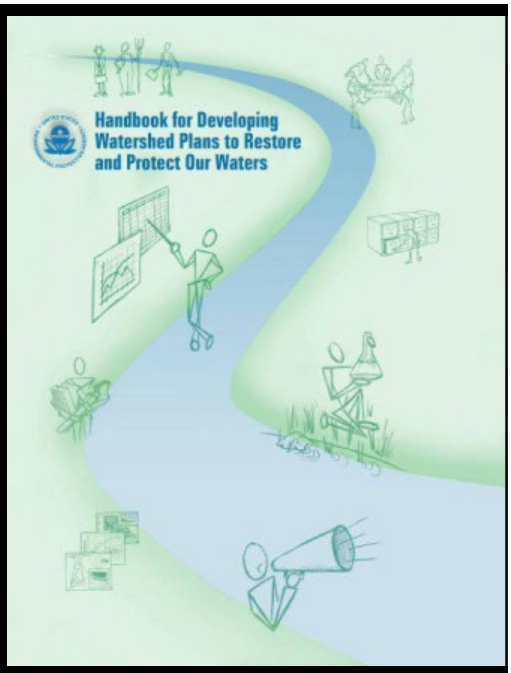
- Watershed plans needed to restore impaired waters & protect other waters
- Plans are required for projects funded with 319 incremental funds
- If TMDL exists, plan must incorporate TMDL load reductions
- If TMDL developed after plan, it must be amended to reflect TMDL load limits
- Plans should be designed to meet water quality standards
- Plans must include nine elements ("a-i")

EPA's Nine Key Elements for Plans

1a. Identify causes & sources of pollution
2b. Estimate load reductions expected from BMPs
3c. Describe mgmt measures & targeted critical areas
4d. Estimate technical and financial assistance needed
5e. Develop an education component
6f. Develop a reasonably expeditious project schedule
7g. Describe interim, measurable milestones
8h. Identify indicators to measure progress
9i. Develop a monitoring component

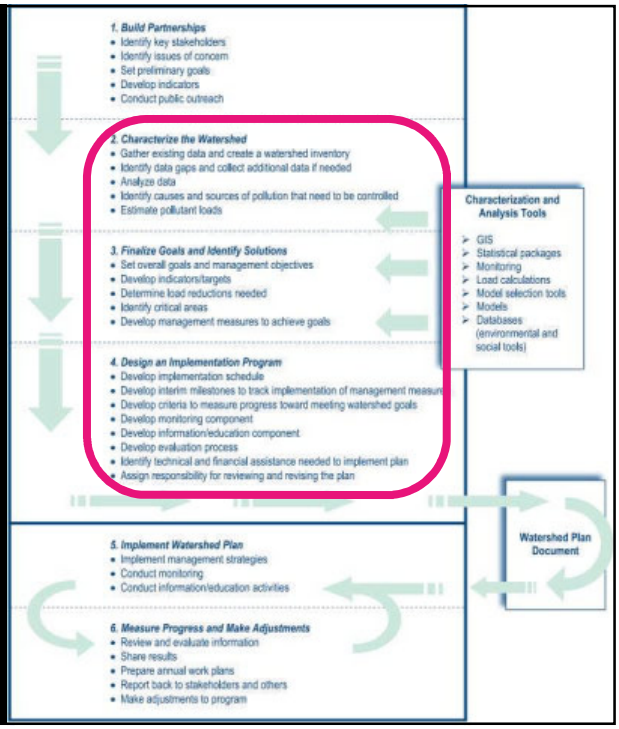
Source: US EPA, 2004 319 Supplemental Guidelines

Watershed Planning Handbook



http://www.epa.gov/owow/nps/watershed_handbook/

Steps in the Watershed Planning and Implementation Process



2. *Characterize the Watershed*

- Gather existing data and create a watershed inventory
- Identify data gaps and collect additional data if needed
- Analyze data
- Identify causes and sources of pollution that need to be controlled
- Estimate pollutant loads

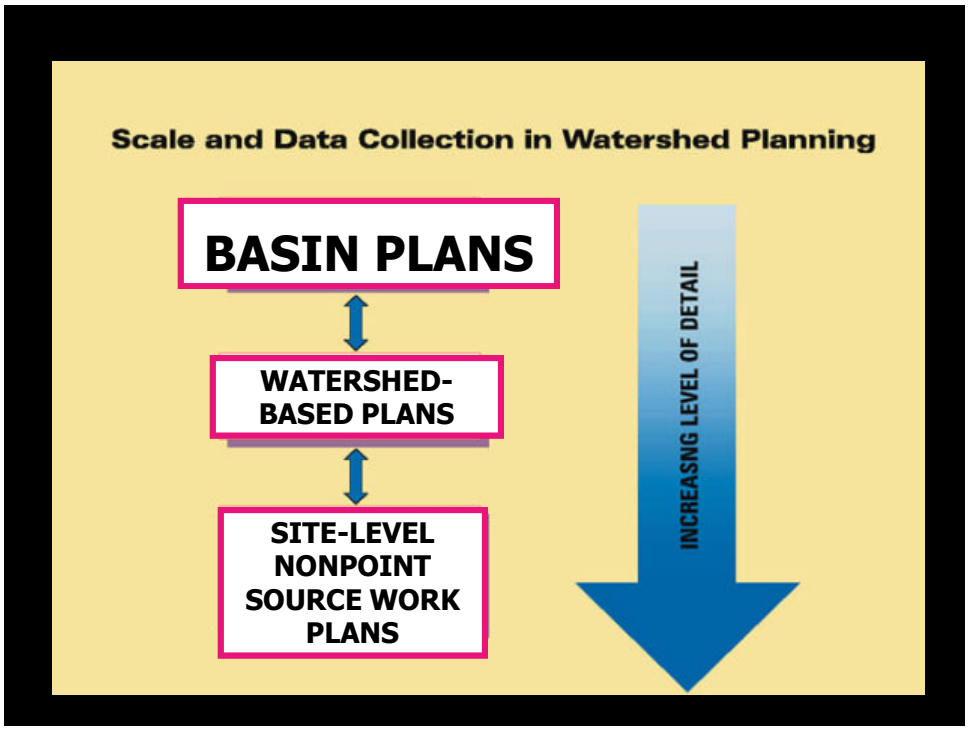
3. *Finalize Goals and Identify Solutions*

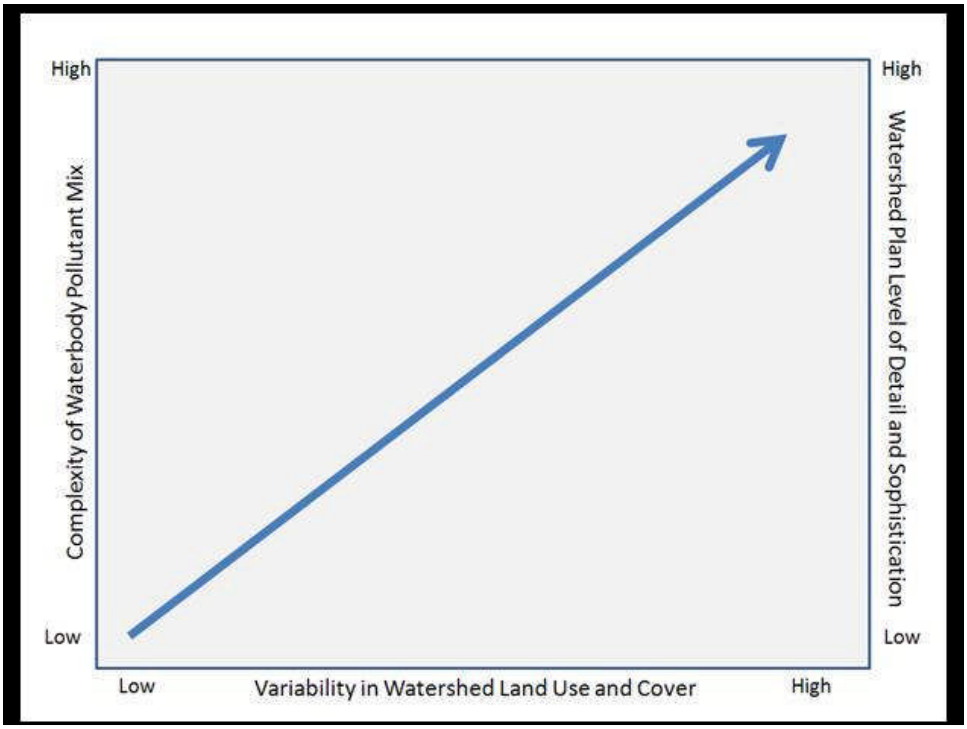
- Set overall goals and management objectives
- Develop indicators/targets
- Determine load reductions needed
- Identify critical areas
- Develop management measures to achieve goals

Incorporation of the nine key plan elements

4. *Design an Implementation Program*

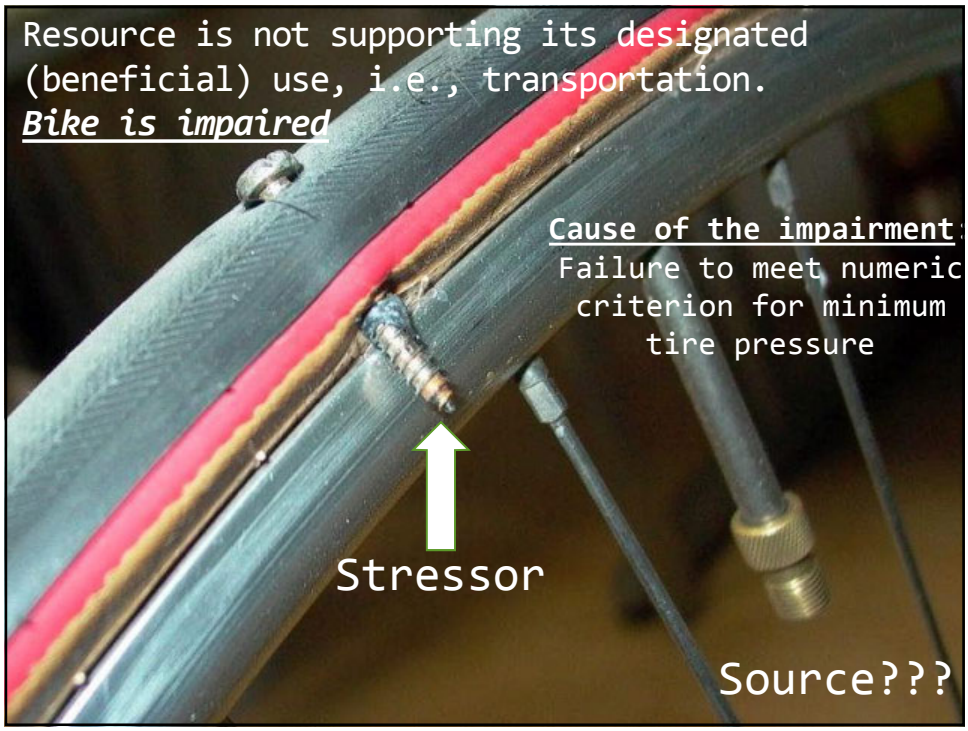
- Develop implementation schedule
- Develop interim milestones to track implementation of management measures
- Develop criteria to measure progress toward meeting watershed goals
- Develop monitoring component
- Develop information/education component
- Develop evaluation process
- Identify technical and financial assistance needed to implement plan
- Assign responsibility for reviewing and revising the plan


Scale and Data Collection in Watershed Planning
BASIN PLANS
WATERSHED-BASED PLANS
SITE-LEVEL NONPOINT SOURCE WORK PLANS
INCREASNG LEVEL OF DETAIL



(1a) Identification of the causes and sources of impairment or threats to the waterbody

- Water body use designations and water quality criteria
- Impaired, partially impaired, and/or threatened uses (from state 303[d] or integrated report) are listed
- Specific causes and sources of impairments and/or threats (if applicable) are listed by segment or area
- Causes of impairment (or threats) listed as loads, WQC exceedance amounts, %, or otherwise quantified
- Sources of impairments/threats mapped or identified by area, category/subcategory, facility type, etc.
- Contributions from each source location or category are quantified by load, percentage, priority, or other method
- Estimates, assumptions, or data used in the analysis are presented or cited and appear reasonable



(2b) Estimate of the load reductions expected from proposed management measures

- Load reductions needed to address each impairment and threat (if applicable) are listed & quantified by weight, concentration, percentage reduction needed, etc
- Listed load reduction estimates are linked to each cause and source location or category
- Load reductions will achieve water quality criteria, address threats, achieve other goals
- Estimates, assumptions, or data used are presented or cited and appear reasonable

What is a "load?"

- Maybe measured by weight . . .
  - Kilograms per day
  - Pounds per week
  - Tons per month
- Maybe not . . .
  - Concentration-based expression of the "load" (e.g., milligrams per liter)
  - Percentage reduction in monitored values needed to meet water quality criteria
  - # of miles of streambank needing stabilization or vegetation
  - # of AFOs requiring nutrient plans
  - % reduction in stormwater flow needed

Existing loads come from:

- Point-source discharges (NPDES facilities)
  - Info is available on the discharges (DMRs, etc.)
  - Some are steady-flow, others are precip-driven
- Nonpoint sources (polluted runoff)
  - Mostly precip-driven, plus irrigation/groundwater
  - Calculating the "wash-off / runoff" load is tough
  - Literature values can be used to estimate
  - Modeling gets you closer . . . . do you need it?
- Air / atmospheric deposition
  - Can be significant in some locations

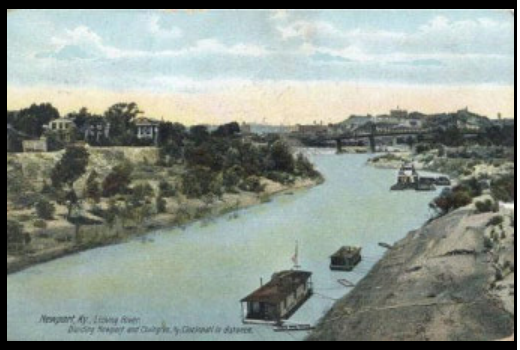
Figure 24: Estimated total sediment delivery and average sediment delivery rates from mass wasting over the period of record (approximately 1957 to 1996) for individual Cal Water Planning Units in the Garcia River watershed. Adapted from O'Connor Environmental, Inc. (1997) and Pacific Watershed Associates (1997).

Planning Watershed	Predominant Sub-basins	Area (mi^2)	Original Sediment Delivery Rate ($t/mi^2/yr$)	Original Sediment Delivery estimate (tons)	Shallow rapid landslide component (tons)	Shallow rapid landslide component adjusted based on L-P data (tons)	Other landslide component adjusted based on CFL data (tons)	Estimated Inner gorge component (tons)	Total modified Sediment Delivery estimate (tons)	Modified Annual Sediment Delivery rate ($tons/mi^2/yr$)
113.70010	Pardaloe & Mill Creeks	16.4	8	5,500	5,500	8,250	0	137,800	146,050	223
113.70011	Larmour Creek & Garcia	10.2	211	86,000	34,800	52,200	61,440	85,700	199,340	489
113.70012	Stansbury Creek, Whitlow Creek & Garcia	6.2	298	74,000	16,400	24,600	69,120	52,100	145,820	588
113.70013	Blue Waterhole Creek	7.7	263	81,000	29,400	44,100	61,920	64,700	170,720	554
113.70014	Inman Creek	8.6	79	27,000	13,600	20,400	10,680	72,200	103,280	300
113.70020	Signal Creek	6.2	77	19,000	8,100	12,150	13,080	52,100	77,330	312
113.70021	Graphite Creek & Garcia	5.4	238	51,000	35,900	53,850	18,120	45,400	117,370	543
113.70022	Beebe Creek & Garcia	4.1	396	65,000	27,500	41,250	45,000	34,400	120,650	736
113.70023	South Fork & Garcia	8.7	218	76,000	21,600	32,400	65,280	73,100	170,780	491
113.70024	Rolling Brook, Lee Creek, Hutton Gulch & Garcia	12.5	156	78,000	40,400	60,600	45,120	105,000	210,720	421

Identification of pollution causes & sources

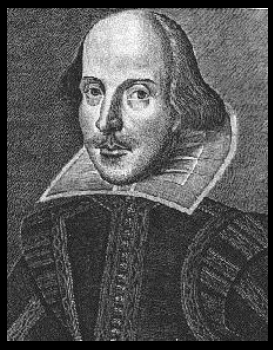
- What "pollutants" are you dealing with?
  - Chemical, physical, biological stressors
- How big is the problem for each?
- How do you know?
  - Did you "measure" them?
  - Did you estimate? How?
- Where are they coming from?
  - Can you put the info on a map?
- Can you estimate the % from each source?

Reducing loads: the basics



- Simple (linear) approach
  - Use observed data
  - Empirical relationships
  - Reduce the concentration
  - Reduce the source area
  - Reduce # of sources
- Complex (modeled) approach
  - Model the loadings
  - Model BMP reductions
  - Layers can include topography, soils, climate, land use, land cover, pollutant transport/fate, point sources, management practices, etc.

To model, or not to model . . .



- As these things increase:
  - Number of pollutants
  - Complexity of loads/stressors
  - Uncertainty regarding existing information
  - Expense involved in addressing problems
- The need for more sophisticated approaches to assessment & BMP performance also increases

Examples of Different Scenarios to Meet the Same Load Target

Source	Existing Phosphorus Loading (kg/y)	Scenario 1		Scenario 2	
		% Load Reduction	Allowable Load (kg/y)	% Load Reduction	Allowable Load (kg/y)
Roads	78	26	58	20	62
Pasture/Hay	21	26	16	10	19
Cropland	218	26	162	55	98
Forest	97	26	72	0	97
Landfill	7	26	5	0	7
Residential	6	26	5	0	6
Groundwater	111	26	83	0	111
Total	539	26	400	26	400

(3c) Description of the management measures needed to achieve the proposed load reductions

- Water quality & other watershed goals listed
- Management measures needed for causes and sources of pollution / impairment / threat are listed, described, prioritized
- Proposed management measures are applicable to causes & sources & are feasible
- Critical locations or high-priority sites for each management measure are mapped/described
- Load reductions linked to each management measure are listed and quantified via reasonable estimates
- Estimates, assumptions, or data used are presented or cited and appear reasonable

Proposed management measures

- Load reductions needed
  - Estimate quantitatively
  - Metrics selected should make sense!
- BMP types proposed
  - What will lessen your 'loads'?
  - Applicable to your situation?
- Load reductions from BMPs
  - How can you measure BMP impacts?
  - Use literature or actual values
- BMP installation sites
  - Which sites will hit the source(s)?
  - Are there critical areas to focus on?

Prioritizing/targeting BMPs

- Importance of waterbody
  - Drinking water source, recreational resource
- Magnitude of impairment(s)
  - Level of effort needed; public interest/attention
- Existing loads (stressors & sources)
  - Magnitude, spatial variation, clustering
- Ability of BMPs to reduce loads
  - Sure thing, or a reasonable projection?
- Feasibility of implementation
  - Willing partners? Public support?
- Additional benefits
  - Recreational enhancements, demonstration

(4d) Estimate of the amount of technical, financial, and regulatory assistance needed

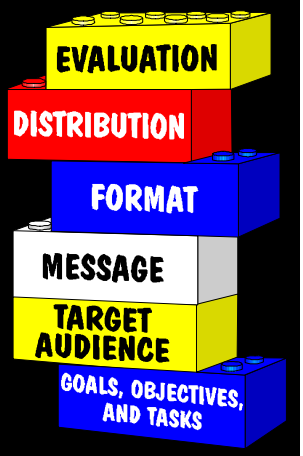
- General type & amount of technical assistance needed to implement the management measures are listed
- Actual or potential/possible sources of the needed technical assistance are identified
- Costs for implementing, operating, and maintaining the management measures are estimated and listed
- Possible/potential sources of financial assistance needed to implement the management measures are listed
- Regulatory or other authorities responsible for (or needed) to implement the management measures are listed; entities exercising the regulatory or other authorities are identified

Yellow Bank Creek Watershed, Alabama

Item Description	Number	Average Cost	Budget Federal	Nonfed	Total
Channel bank vegetation	20 acres (seed, sod, tree planting; lime, fertilizer; land preparation)	800/ac	10,667	5,333	16,000
Critical area planting (seed, lime, fertilizer; grading and shaping)	20 acres (seed, lime, fertilizer; grading and shaping)	164/acre	2,187	1,093	3,280
Fencing	6,567 ft (4 strand barb; steel post)	0.77/ft	3,371	1,686	5,057
Fence gate assembly	15 (14-ft each)	190 each	1,900	950	2,850
Livestock exclusion	13,133 ft (4 strand barb; steel post)	0.77/ft	6,741	3,371	10,112
Pasture hayland planting	100 acres (seed, lime, fertilizer)	164/acre	10,933	5,467	16,400
Well drilling and casing	3 each (300 ft depth)	21/ft	12,600	6,300	18,900
Piping	6,800 ft (1” PVC to water troughs)	0.85/ft	3,853	1,927	5,780
Pumps	3 each (livestock alternative water)	1,110 each	2,227	1,113	3,340

(5e) Public information, education, and participation

- Information, education, and public participation goals and objectives for the management program are listed
- An overall strategy or plan for the public information, education, and participation component is provided

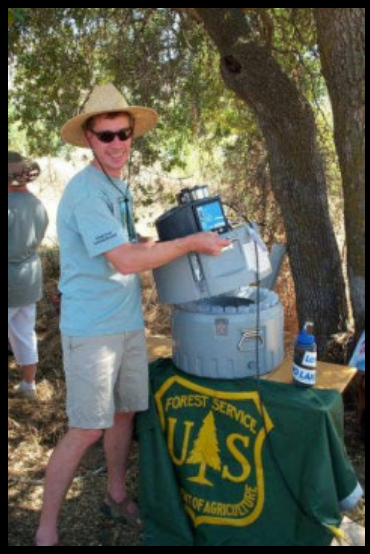


(6f) Reasonably expeditious schedule for implementation

- Overarching timeline or schedule showing projected dates for developing and implementing each management measure (BMP) is presented
- The timeline or schedule indicates the actions, steps, or accomplishments associated with implementing the management measures in the plan
- The timeline or schedule follows a logical sequence for implementing the management measures
- The timeline or schedule lists short-term (up to 3 yrs) and long-term (up to 10 or more yrs) implementation steps

(7g) Interim measurable milestones for implementing the management measures

- A list of reasonable and attainable interim milestones, benchmarks, phases, or steps for implementing each group of management measures or control actions is provided
- A logical sequence of dates for achieving the milestones, benchmarks, phases, or steps is listed



Corsica River in Maryland

TABLE 5

Summary of Implementation Project Costs and Reductions

Best Management Practice (BMP)	Goal	Cost		Nutrient Reduction/Lbs.
1. Nutrient Uptake	3,000 acres		$90,000.00	21,000 N, 570 P
2. AG Nutrient and Sediment Reducing Buffers	100 acres	($170/ac + staff)	$67,000.00	9,188 N, 792 P
3. Whole Farm Nutrient Management and Horse Pasture Management	5 projects	($25,000.00/site)	$125,00.00	15,977 N, 1,944 P
4. Household Pollution Reduction	400 acres		$3,696.00	634 N, 118P
5. Main Stem of the Corsica River: Water Quality Monitoring			$345,434.00	
6. Submerged Aquatic Vegetation (SAV) Reestablishment			$48,000.00	
7. Low Impact Development Technique in Ordinance Form		Ordinance $37,000.00/Regional BMPs	$272,385.00	2,668 N, 236 P
8. Native Conservation Landscaping Demonstration Project			$78,410.00	Est. 70% Reduction
9. Easements Incentive Program	1,710 acres	($2,437.00 ac.)	$4,167,270.00	
10. Creation of Non-Agricultural Wetlands			$22,000.00	
11. Septic System Retrofits			$141,000.00	28,905 N
12. EcoTeams			$93,500.00	
13. Turbidity Reduction		(cost for first 10 ac.)	$145,000.00	
Total with All Programs, Complete			**$9,423,320.00**	
Total without Easements (9) and Total Septic Conversion (11)			**$1,378,550.00**	

(8h) Criteria to determine whether or not load reductions are being achieved

- Criteria are identified that are linked to the causes and/or sources of impairments/threats (if applicable)
- The listed criteria include numeric and/or narrative water quality criteria, instream physical habitat assessment criteria, or other criteria linked to the causes/source
- Listed criteria include those incorporated into any TMDLs developed or to be developed for waterbodies addressed by the plan
- Provisions for reviewing progress and revising the plan or any TMDLs involved are addressed

(9i) Monitoring component to evaluate the effectiveness of implementation

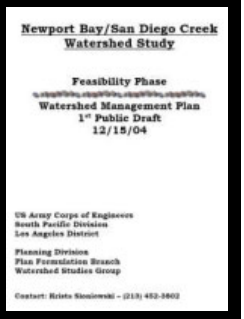
- An approach for establishing monitoring sites or procedures and relevant parameters is provided, or procedures for acquiring and reviewing other monitoring data is described
- Monitoring parameters relate to the criteria identified in (h)
- Frequency of monitoring or schedules for assessing implementation progress is included / referenced
- Parties responsible for monitoring are listed / referenced
- Quality Assurance Project Plans for water quality parameters are referenced or cited, if appropriate

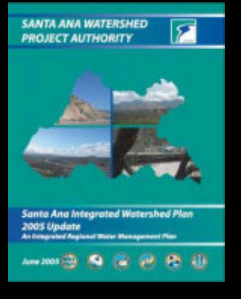
Figure 31: Summary of Monitoring Parameters and Protocols

Parameter	Protocol	Brief Description (Protocol should be consulted for detailed methodology)	Frequency
		INSTREAM MONITORING	
Sediment-related barriers	Any defensible method	Stream survey; identification of sediment deltas, underground stream sections, shotgun culverts, reaches with water depths less than 0.18 meters, etc.; measurement or estimate of extent of barrier and mapping of location	Annual
Embeddedness	Flosi and Reynolds (1994), Burns (1984)	Identify at least 5 riffle habitat units in Class I streams. Randomly select at least 50 cobbles from each habitat unit and measure or estimate the percent of each cobble which is covered or surrounded by fines. This will be obvious from a dark ring around the cobble indicating its exposure to stream flow. Rate each cobble 1, 2, 3, or 4 as follows: score of 1=cobbles 0-25% surrounded or covered by fines; 2=26-50%; 3=51-75%; 4=76-100%	Annual
% fines, gravel composition	McNeil protocol, Valentine (1995)	Identify at least 5 riffle habitat units in Class I streams. Collect at least 2 bulk core samples of sediment in each habitat unit in the first at the pool/riffle break immediately downstream of pool crests. Measure the of volume sediment associated with each size class in the field. Bag at least 5 samples to be weighed in the laboratory to establish a correlation between weight and volume.	Annual
Pool characteristics	Flosi and Reynolds (1994)	Identify at least 10 pool habitat units within a reach that is 20-30 bankfull widths long in Class I streams. Measure habitat unit length, characterize habitat types in each unit, and measure mean width of low flow channel. Measure maximum length, width and depth of all pools in each unit. Measure depth of each pool tail crest.	Annual
Frequency of primary pools	Flosi and Reynolds (1994)	Within each reach (as described above), identify the maximum length of all pools which are >3 feet deep, > in width than 1/2 width of low flow channel, and > in length than width of low flow channel.	Annual
V*	Lisle and Hilton (1992), Knopp (1993)	Identify at least 10 survey units within a reach of 20-30 bankfull widths in length in 3rd order streams with slopes 1-4%. Measure the residual volume of each pool within the unit with a graduated rod along transects, as described by Lisle and Hilton.	Annual
D50	Wolman (1954), Knopp (1993), Rosgen (1996)	Identify at least 5 survey units within a reach of at least 20-30 bankfull channel widths long in 3rd order streams with slopes 1-4%. Lay out transects, as described by Rosgen, and collect at least 100 particles in each reach. Measure the particle, as described, and tally for later graphing.	Annual
Volume of large woody debris	Shuett-Hames (1994) for Timber, Fish and Wildlife Watershed Assessment Manual (Level 2 analysis)	Identify at least 10 survey units of at least 500 feet long within Class I, II and III streams. Identify and measure all pieces of large woody debris, including logs at least 4 inches in diameter and 72 inches long and root wads. Note the location of the LWD in the channel, the channel length, wood type, stabilizing factors, pool formation function and orientation and decay class.	At least once every three years

General Contents of a Watershed-Based Plan

- Introduction
  - Plan area & description, partners, background
- Water quality information & analysis
  - WQS & goals, monitoring/assessment results
  - Key pollutants / stressors, sources, current loads
- Proposed management measures
  - Load reductions needed, BMP types proposed
  - Reductions expected from BMPs, installation sites
- Implementation plan
  - Public info/education & outreach/involvement plan
  - BMP/$$/TA support sources, project schedule & costs
- Monitoring and adaptive management approach
  - Interim measurable milestones, load reduction criteria
  - Evaluation framework, monitoring plan & partners





US EPA OWOW HQ NPS Branch Review of Plans

- 2006 review of the "best" 30 watershed plans submitted by states
- 2008-2010 review of 49 plans from all US EPA regions

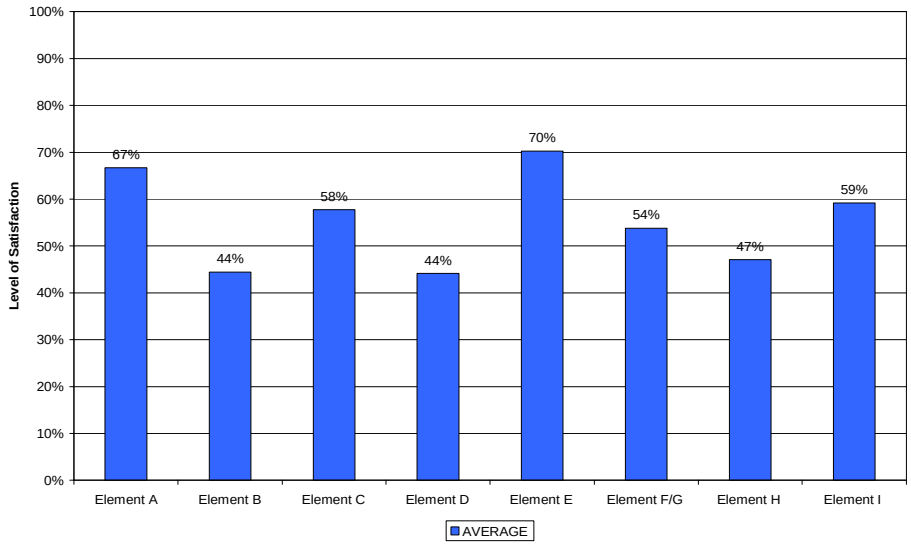
A National Evaluation of the Clean Water Act Section 319 Program

November 2011

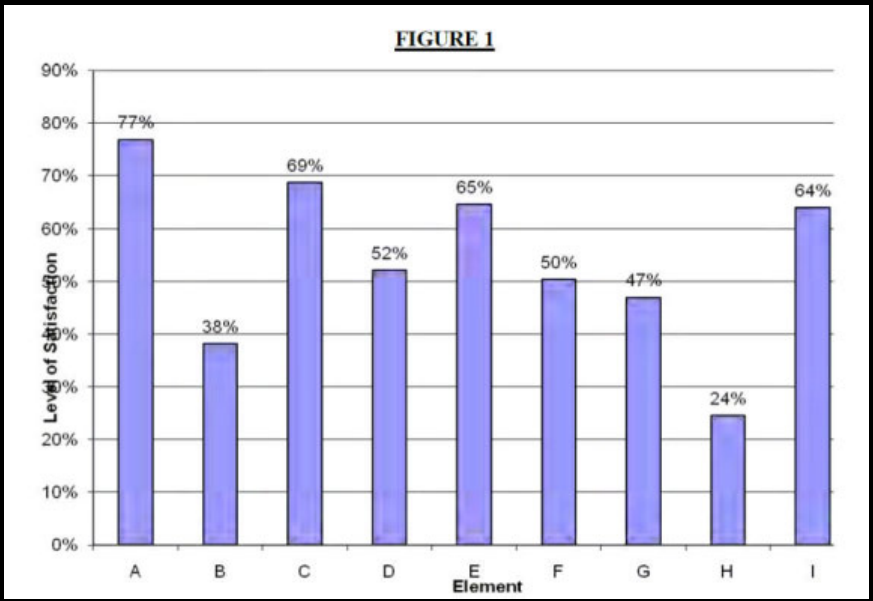
U.S. Environmental Protection Agency
Office of Wetlands, Oceans, & Watersheds
Assessment & Watershed Protection Division
Nonpoint Source Control Branch

2006 US EPA Study Results

Figure 1: EPA Watershed Planning Elements: National Trends

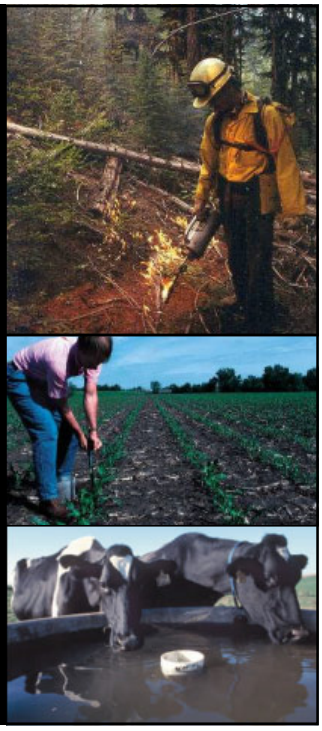


2008 – 2010 US EPA Study Results



Common mistakes found in plans

- Scale
  - Too large a planning area, based on sheer size or size-plus-complexity
- Omitting key components
  - Load reduction estimates, milestones
- Forgot to set a goal/target
  - Usually, it's numeric/narrative WQC
- No adaptive management
  - Plans aren't one-shot solutions!



1 CAUSES/SOURCES OF POLLUTION ARE IDENTIFIED		
Goals for restoration & protection are clearly defined, quantified & thoroughly explained		8.0%
	Impaired, partially impaired, and/or threatened water bodies on the 303(d) list are identified	
	Goals are clearly defined, and quantified (if applicable)	
Causes/sources of pollution that need to be controlled to meet goals are identified as it applies to areas for restoration and protection		14.0%
	Sources of pollution, both point and non point, are mapped/causes identified	
	Loads from identified sources are quantified	
	Watershed sufficiently subdivided by landuse type, cover or other characteristics to enhance the assessment of sources and strategic placement of BMP's	
	Data sources, estimates and assumptions are cited & documented	
	Data Gaps Identified if they exist, but data gaps not significant enough to delay implementation	

"Identification of pollutant sources and reductions needed to meet water quality standards (component A1) are the essence of TMDLs; in a number of cases, TMDLs had already addressed this component to a significant extent, thereby setting a foundation for the plan.

In the few plans that did not satisfy this component, load estimates from significant source categories were absent, or the sources of pollution that need to be controlled were not quantified at a level that is useful for waterbody remediation."

2 EXPECTED LOAD REDUCTIONS FOR SOLUTIONS IDENTIFIED		18.0%
	Expected load reductions are linked to a pollution cause/source identified in (A)	
	Expected load reductions are analyzed to ensure water quality criteria, and/or other goals will be achieved	
	Basis of load reduction effectiveness estimates is thoroughly explained	
	Significant estimates, assumptions, and other data used in the analysis are cited & verifiable	

"The watershed planning process isn't necessarily about getting exactly the right answer the first time. Rather, it is about successfully employing an adaptive management approach in which available information and analytical tools are used to support the best planning decisions that can be made.

The best plans were not necessarily relying on the most sophisticated watershed models or making any claims that their load estimates are 100% correct. In fact, some plans contained explicit discussions stating factors that may lead to errors in the estimates. However, it is critical that the best effort be made to develop good estimates; set a bar to measure whether or not the proposed measures are adequate; and establish a feedback loop to determine if there are additional issues in the watershed that may have been missed when the plan was first written."

3 NONPOINT SOURCE MANAGEMENT MEASURES IDENTIFIED		14.0%
	Management measures needed to address causes/sources of pollution identified in (A) are listed, described, and mapped (if known)	
	Explanation for the selection of measures is included to ensure they are applicable to the pollutant causes/sources and are feasible and acceptable	
	Management measures are prioritized based on critical pollutant causes/sources, type, and location as well as compatibility with landowner operations	
	Significant estimates, assumptions, and other data used in the analysis are cited & verifiable	

"Most states were able to do this without significant difficulties. However, some states failed to adequately explain why certain management measures were chosen over similar alternatives.

The discrepancy between the level of satisfaction in components B(2) and C(3) suggests plan writers can successfully identify best management practices to address pollutants, but many are having a difficult time quantifying the expected load reduction from these practices."

4 ESTIMATE OF TECHNICAL & FINANCIAL ASSISTANCE		
Estimate of Technical Assistance needed		4.0%
	Significant existing sources of technical assistance that may be needed to implement the plan are accounted for.	
	Additional technical assistance needs are identified, and referenced back to the solutions	
Estimate of Financial Assistance Needed		4.0%
	General cost estimate is included by task (project work plans should have more detailed cost information)	
	Multiple funding sources are listed, as well as an estimated contribution from each source	

"Component D was met with a moderate degree of success. The best plans were able to list the partners that would be called upon to complete each action in the plan, and included a full cost estimate, including possible sources of funding.

Other plans were commonly missing one or more of these pieces of information or included all of this information at a level of detail that was much lower than the best plans."

5 EDUCATION/OUTREACH		8.0%
	Reaches out to the appropriate sectors of the population in the watershed	
	Both educates public and encourages participation	
	Encourages the implementation of BMP's necessary to fulfill the plan requirements	
6 IMPLEMENTATION SCHEDULE		6.0%
	Timeline presents projected dates for the development and implementation of the actions needed to meet the goals of the plan and includes information on how implementation will be tracked	
	Implementation of point source and regulatory activities are coordinated with nonpoint source actions and other watershed implementation activities	

"Most of the time, some kind of education campaign was included (passing out flyers, PSA's etc) but an explanation of how these campaigns would enhance public understanding or encourage involvement was absent.

In these cases, there is a serious question whether adequate community understanding of and support for the watershed plan and its implementation have been established."

"A schedule helps ensure that the plan's developers have thought about the feasibility of their plan in relation to its objectives and available resources. It also helps to ensure the continuous implementation of the plan.

In many cases, plans failed to include a schedule beyond a year of implementation, or had a much less detailed schedule compared to the best plans reviewed."

7 MILESTONES IDENTIFIED		6.0%
	Milestones are measureable and attainable	
	Includes expected completion dates to ensure the continuous implementation of plan	
8 SHORT TERM CRITERIA TO ENSURE PROGRESS IS BEING MADE TOWARDS ATTAINING WATER QUALITY STANDARDS		9.0%
	Interim numerical criteria present	
	Expected dates of achievement identified.	
	Includes a review process to determine if the reductions are being met	
	Includes criteria to determine whether the watershed based plan needs to be revised based upon failure to make adequate progress in accordance with the implementation schedule	

"There seemed to be confusion between what was required with respect to components G(7) and H(8). Many times, the criteria that would be used to determine whether loading reductions were being achieved were actually milestones; this indicates that there was confusion surrounding the difference between the two.

The criteria should be expected levels of pollutants of concern in the waterbody at different points in time, whereas milestones indicate achievement of implementation steps like the number of BMPs that will be installed in a certain year. Many plans also failed to identify how often progress would be reviewed, and who would actually be responsible for reviewing the plan to determine this information."

9	**MONITORING COMPONENT**	9.0%
	Includes description of how monitoring will be used to evaluate the effectiveness of the implementation efforts	
	There is a routine recording element in which progress and methodology are evaluated.	
	Monitoring is tied to a quality assurance plan	
	Parties responsible for monitoring are identified	

"Most plans were relying on the implementation of existing state monitoring programs, which have well established procedures, so component I(9) is relatively straightforward. In a very small number of plans, responsibility for monitoring was unclear, as well as how often monitoring would take place."

General Results

Based on the above described scoring system, the average score for all of the plans was 56%. Figure 1 presents the average score for each of the 9 watershed based plan components required in 319 plans.

The majority of reviewed plans have done very well with respect to the following components:

- Identifying causes and sources of pollution that need to be controlled to achieve watershed goals (Component A);
- Describing the NPS management measures that need to be implemented to achieve watershed goals (Component C);
- Developing an information/education component that will be used to enhance public understanding of the project and encourage their early and continued participation in selecting, designing, and implementing NPS management measures (Component E); and
- Including a monitoring component to evaluate the effectiveness of the implementation efforts over time (Element I)

Estimating load reductions: still the weak spot

However, many states continue to struggle with estimating load reductions expected for the management measures selected, and setting criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made towards attaining water quality standards (components B and H). Components B and H were found to be problematic in the 2006 review and again were often addressed inadequately in the plans reviewed for this study. These two components go hand in hand; without adequate load reduction estimates, a state cannot develop criteria that can be used to determine whether load reductions are being achieved at an adequate rate over time.

Table 3: Models used in Watershed Based Plans

Model Name	Use
[No Model]	13
Soil & Water Assessment Tool (SWAT)	4
[Revised] Universal Soil Loss Equation ([R]USLE)	3
ArcView Generalized Loading Function (AVGWLF)	3
Loading Simulation Program in C++ (LSPC)	3
Speadsheet Tool for Estimating Pollutant Loads (STEPL)	3
Stormwater Management Model (SWMM)	3
Automated Geospatial Watershed Tool (AGWA, uses Kinematic Runoff and Erosion Model (KINEROS2) and SWAT)	2
Hydrologic Simulation Program Fortran (HSPF)	2
Long Term Hydrologic Impact Assessment (L-THIA)	2
Pollution Reduction Impact Comparison Tool (PreDICT)	2
Annualized Agricultural Non-Point Source Pollution Model (Ann AGNPS)	1
AVNPS	1
Bacteria Indicator Tool	1
Bacteria Source Load Calculator	1
BATHTUB	1
Environmental Fluid Dynamics Code (EFDC)	1
FLUX	1
Impervious Cover Model	1
Integrated Pollutant Source Identification Pollutant Loading Model (IPSI/PLM, from TVA)	1
Method for Assessment, Nutrient-loading and Geographic Evaluation of watersheds (MANAGE)	1
BASINS Nonpoint Source Model (NPSM)	1
Nonpoint-Source Pollution and Erosion Comparison Tool (NSPECT)	1
PLAT/NLEW	1
Pollutant Load Screening Model (PLSM)	1
QUAL2E	1
R5 Pollutant Control Model	1
SELECT	1
Site Evaluation Tool (SET)	1
Stream Network Temperature model (SNTEMP)	1
Watershed Management Model	1
Watershed Treatment Model	1
Delaware Inland Bays Model (Based on CB Model)	1
Sediment Delivery Calculator	1
CE-QUAL-ICM	1