Appendix V

Matrix for Section 319 National Monitoring Program Projects

PROJECT	BASIN SIZE	IMPAIRMENT(S)	POLLUTANT(S)
Alabama: Lightwood Knot Creek	68 mi^2	(Lake Jackson and tributaries) ◆Recreation ◆Aquatic life support	◆Sediment ◆Nutrients (N & P) ◆Bacteria
Arizona: Oak Creek Canyon	9 mi^2	◆Primary contact recreation ◆Aquatic life support ◆Drinking water supply	◆Bacteria ◆Nutrients (N)
California: Morro Bay Watershed	76 mi^2	◆Estuarine and fresh water habitat ◆Shellfish harvesting ◆Recreation	◆Sediment ◆Nutrients ◆Bacteria ◆Metals
Connecticut: Jordan Cove Watershed	<1 mi^2	◆Jordan Cove: shellfish harvesting ◆Long Island Sound: habitat, recreation	◆Sediment ◆Fecal coliform ◆Nutrients (N) ◆Metals
Idaho: Eastern Snake River Plain	47 mi^2 (ground water monitoring) 20 acres (test fields)	◆Drinking water supply (ground water)	◆Nitrate
Illinois: Lake Pittsfield	11 mi^2	◆Drinking water supply ◆Recreation	◆Sediment ◆Nutrients
Illinois: Waukegan River	12 mi^2	◆Aquatic life support	◆Peak stormwater flows ◆Sediment ◆Loss of physical habitat
Iowa: Sny Magill Watershed	36 mi^2	◆Recreation ◆Aquatic life support	◆Sediment ◆Nutrients ◆Animal waste ◆Pesticides
Iowa: Walnut Creek	38 mi^2	◆Aquatic life support (Mississippi River and Gulf of Mexico)	◆Sediment ◆Nutrients (nitrate ◆Herbicides
Maryland: Warner Creek Watershed	1mi^2	◆Aquatic life support (Monocacy River and Chesapeake Bay)	◆Sediment ◆Nitrogen ◆Phosphorus

POLLUTANT SOURCE(S)	WATER QUALITY OBJECTIVES	WATER QUALITY MONITORING DESIGN
◆Agricultural fields ◆Poultry operations	◆Control erosion ◆Reduce nutrient loading to streams	Paired watershed 2 paired sites - 2 control / 2 treatment
◆Recreational users ◆Aquatic sediments ◆Septic systems ◆Natural/background ◆Unknown	◆Reduce fecal coliform by 50% ◆Reduce nutrient levels (NH_3) 20%	Upstream / downstream
◆Cropland and rangeland ◆Urban areas and roads ◆Unstable streambanks ◆Abandoned mines	◆Evaluate effectiveness of several BMP systems ◆30% to 66% reduction in sediment yield	◆Paired watershed 1 control / 1 treatment ◆3 upstream/downstream ◆1 single downstream site
◆Urban runoff ◆Construction	◆Demonstrate water quantity/quality benefits of urban/residential BMPs ◆Maintain post-development peak runoff rate and volume at pre-development rates ◆Reduce N 65%, P 40%, FC 85%	◆Paired watershed: 1 control/ 2 treatment ◆Two treatment periods: construction and post-construction
Irrigated cropland: ◆Excessive irrigation ◆Excessive N inputs	Evaluate nitrate-reducing BMPs at the field scale ◆Evaluate effects of irrigation water management on nitrate leaching to shallow ground water ◆Evaluate effects of crop rotation on nitrate leaching to shallow ground water	◆Paired fields 2 control / 2 treatment
◆Cropland ◆Streambanks/channels ◆Small livestock operations	◆Reduce sediment loads to lake ◆Evaluate effectiveness of sediment retention basins	Before/After: ◆4 subwatershed stations ◆3 in-lake stations
◆Urban impervious surfaces ◆Streambank erosion	◆Restore streambanks ◆Reduce or mitigate effects of stormwater on aquatic habitat ◆Restore stream fishery	◆Upstream / downstream
◆Cropland ◆Livestock facilities ◆Streambank erosion	◆Reduce sediment loads by 50% ◆Reduce N, P, pesticide loads by 25% ◆Decrease streambank erosion rates ◆Implement 30 animal manure management systems	◆Paired watershed: 1 control / 1 treatment ◆Upstream/downstream in subbasins
◆Cropland ◆Streambank erosion	◆Demonstrate/evaluate prairie restoration as BMP for water quality ◆Reduce nitrate, phosphorus, herbicide and sediment loads	◆Paired watershed/trend analysis 1 control/ 1 treatment ◆Upstream / downstream subbasin stations
◆Dairy operations ◆Animal waste ◆Cropland ◆Pasture	◆Collect WQ data to develop and calibrate a SWAT model application to predict effects of BMPs on water quality in MD ◆Illustrate relationships between BMPs and WQ	◆Paired watershed 1 control / 1 treatment ◆Upstream/downstream

PROJECT	SAMPLING SCHEME	PRIMARY WATER QUALITY VARIABLES
Alabama: Lightwood Knot Creek	◆Discharge monitored continuously ◆Weekly composites April - September ◆Weekly grab samples for bacteria ◆Biological monitoring 2 times/year	◆Physical: turbidity, TSS, bedload, TDS, conductance ◆Chemical: TP, OP, NH_3, NO_3 ◆Biological: fecal bacteria, macroinvertebrates, habitat
Arizona: Oak Creek Canyon	◆Weekly grab samples during recreation season (May - Sept.) ◆Monthly grab samples Nov-April	FC, NO_3, NH_3, TN, OP
California: Morro Bay Watershed	◆Event/baseflow automated ◆Even interval grab sampling ◆Annual biomonitoring ◆Stream channel transects, vegetation monitoring	SS, turbidity, NO_3, PO_4, fecal coliform Macroinvertebrates, habitat Riparian and rangeland vegetation
Connecticut: Jordan Cove Urban Watershed	◆Storm event (automated, flow-proportional composites) ◆Grab samples (bacteria, BOD) ◆Monthly composites (metals)	Flow, TSS, TP, TKN, NH_3, NO_2 + NO_3, FC BOD, Cu, Pb, Zn
Idaho: Eastern Snake River Plain	◆Monthly ground water grab samples ◆Growing season soil water samples ◆Geospatial/geostatistical analysis used to address hydrogeologic variability of fields	NO_3-N, NO_4-N, TKN, TDS, DO, organic pesticides
Illinois: Lake Pittsfield	◆Storm event sampling (automated) at subwatershed outlets ◆Monthly grab sampling (April - October) in Lake	Subwatersheds: TSS Lake: TSS, VSS, SS, TO, OP, DP, NH_3-N, NO_2+NO_3-N, TKN
Illinois: Waukegan River	◆Seasonal biomonitoring ◆Continuous flow ◆Flow, temperature, DO	◆Fish (IBI) ◆Macroinvertebrates (MBI) ◆Habitat (PBI)
Iowa: Sny Magill Watershed	◆Continuous stage, daily Q and SS ◆Weekly grab samples ◆Annual habitat fisheries assessment ◆Bi-monthly macroinvertebrates	Q, turbidity, SS, TP, N series, DO, fecal coliform, herbicides
Iowa: Walnut Creek	◆Flow, SS monitored daily at watershed outlets ◆Storm event and Biweekly/monthly sampling ◆Annual habitat and fishery survey	Flow, turbidity, SS, P, NO_3, NH_3, BOD, herbicides, Macroinvertebrates, fish
Maryland: Warner Creek Watershed	◆Paired watersheds: grabs weekly (Feb-June) and bi-weekly ◆Upstream/downstream: automated storm samplings; grabs weekly (Feb-June) and bi-weekly	TKN, NH_3, NO_3 + NO_2, NO_3, TP, OP, sediment

BMPs	MAJOR COOPERATING INSTITUTIONS	PROJECT TIME FRAME
◆Runoff and sediment control structures ◆Critical area planning ◆Cover and green manure crops ◆Pasture and hayland management ◆Poultry litter storage / waste management	◆Geological Survey of Alabama ◆Alabama Dept. of Environmental Management ◆USDA NRCS ◆Covington County Extension	1996-2002 Final Report 2002
◆Enhance rest room/shower facilities ◆Public education/signage ◆Enforce litter laws ◆Upgrade septic systems	◆Arizona Dept. of Environmental Quality ◆Northern Arizona University ◆Arizona State Parks	1994-1998 Final Report 1998
◆Livestock exclusion ◆Riparian pasture development ◆Rotational grazing ◆Floodplain restoration/sediment retention	◆Central Coast Regional Water Quality Control Board ◆California Polytechnic State University ◆USDA NRCS	1993-2002 Final Report 2003
◆Phased grading ◆Vegetation management ◆Sediment retention basins/ grassed swales ◆Rain gardens ◆Pervious paving ◆Post-construction maintenance practices	◆University of Connecticut ◆Aqua Solutions, L.L.C. ◆Connecticut DEP ◆Connecticut Cooperative Extension ◆USDA-NRCS	1996-2006 annual reports published
◆Irrigation water management ◆Crop rotation ◆Fertilizer management ◆Pesticide management	◆ID Division of Environmental Quality ◆U. of Idaho Cooperative Extension ◆Boise State University ◆USDA NRCS	1991 - 1998 annual reports published under Demo Project
◆Sediment retention basins/WASCOBs ◆Stream channel stabilization ◆Conservation tillage ◆Integrated crop management ◆Livestock exclusion ◆Filter strips	◆IL State Water Survey ◆IL Environmental Protection Agency ◆Pike Co. Soil and Water Conservation District	1992-1994 annual reports
◆Biotechnical streambank restoration (vegetative + structural) ◆Stream restoration - pool & riffle complexes ◆Waukegan Park District	◆IL Environmental Protection Agency ◆IL State Water Survey ◆IL Department of Natural Resources	1992 -2004 annual reports
◆Structural erosion control practices ◆Integrated crop management ◆Water and sediment control structures ◆Animal waste management systems ◆Grazing management ◆Education and assistance	◆IA DNR-Geologic Survey ◆IA State University Extension ◆USDA NRCS (larger Hydrologic Unit Area and WQ Special Projects	1991-2001 Final Report 2004
◆Conversion of cropland to native prairie ◆Restoration of wetlands and riparian zones ◆Required nutrient management and pest management on remaining cropland	◆IA DNR-Geological Survey ◆US Fish and Wildlife Service 1996	1995 - 2005 Final Report 2006
◆Conversion of cropland to pasture ◆Watering systems ◆Livestock exclusion fencing ◆Manure storage and management ◆Nutrient management	◆MD Department of Natural Resources ◆U. of Maryland Agricultural Engineering ◆USDA-NRCS, CES (Monocacy Demo Project)	1993 - 2003 annual reports

PROJECT	BASIN SIZE	IMPAIRMENT(S)	POLLUTANTS
Michigan: Sycamore Creek Watershed	106 mi^2	◆Aquatic life support ◆Recreation ◆Urban areas	◆Sediment ◆Nutrients ◆BOD
Minnesota: White Water River Watershed	320 mi^2	◆Aquatic life support ◆Recreation	◆Turbidity/sediment ◆Fecal coliform ◆Temperature
Nebraska: Elm Creek Watershed	56 mi^2	◆Aquatic life support (coldwater trout fishery)	◆Sediment ◆Increased water temperature ◆Increased peak flows
New York: New York City Watershed	1 mi^2	◆Drinking water ◆Aquatic life support	◆Phosphorus ◆Sediment ◆Bacteria/pathogens
North Carolina: Long Creek Watershed	44 mi^2	◆Aquatic life support ◆Drinking water	◆Sediment ◆Bacteria ◆Nutrients
Oklahoma: Peacheater Creek	25 mi^2	◆Recreation ◆Aquatic life support	◆Nutrients ◆Loss of habitat ◆Reduced water clarity ◆Periphyton growth ◆Eutrophication (downstream lake)
Oregon: Upper Grande Ronde Basin	695 mi^2	◆Aquatic life support (cold water fish, macroinvertebrates ◆Water supply ◆Recreation	◆Water temperature ◆Loss of physical habitat ◆Loss of riparian vegetation
Pennsylvania: Pequea and Mill Creek Watersheds	3 mi^2	◆Aquatic life support ◆Wildlife habitat ◆Agricultural water supply	◆Bacteria ◆Sediment ◆Nutrients ◆Organic matter

POLLUTANT SOURCE(S)	WATER QUALITY OBJECTIVES	WATER QUALITY MONITORING DESIGN
◆Cropland ◆Livestock access ◆Streambanks	◆Reduce impacts of agricultural nps pollutants on surface and ground water quality ◆Reduce sediment in Sycamore Creek by 52%	◆Paired watershed 1 control/2 treatments
◆Streambank erosion ◆Degraded riparian areas ◆Cropland/pasture ◆Feedlot runoff ◆Livestock access to streams	◆Evaluate effectiveness of BMP implementation implementation on water quality	◆Paired watershed 1 control/multiple treatments
◆Cropland ◆Rangeland ◆Streambank erosion ◆Irrigation return flows	◆Reduce sediment load in Elm Creek by 50% ◆Reduce summer max. water temperature ◆Reduce instream sedimentation ◆Reduce peak flows ◆Improve aquatic habitat	◆Upstream/downstream ◆Single downstream station
Dairy operations: ◆Animal waste ◆Cropland ◆Pasture	◆Test ability of Whole Farm Planning process to correctly identify on-farm pollution sources ◆Quantify reductions in pollutant loading due to implementation of BMPs under Whole Farm Planning	◆Paired watershed 1 control / 1 treatment
◆Cropland ◆Dairy operations ◆Pastures ◆Streambank erosion ◆Urbanization	Quantify the effects of BMPs on: ◆Pollutant loads from dairy farm ◆Cropland sediment/nutrient losses ◆Aquatic biota ◆Reduce sediment yield from water supply watershed by 60%	◆Paired watershed 1 control / 1 treatment ◆Upstream/downstream ◆Single downstream station
◆Poultry houses ◆Land application of litter ◆Dairies & other livestock ◆Streambank erosion ◆Poor riparian management	◆Restore recreation and aquatic life support ◆Minimize eutrophication impacts on downstream lake	◆Paired watershed 1 control / 1 treatment
◆Grazing practices ◆Channel modification ◆Mining ◆Road construction ◆Logging	◆Improve salmonid and aquatic macroinvertebrate communities ◆Quantitatively document a cause & effect relationship between improved habitat, lower water temperatures, & improved salmonid & macroinvertebrate communities	◆Paired watershed 1 control / 1 treatment ◆Upstream/downstream ◆3 Single stations
◆Livestock access to streams ◆Degraded riparian zones	Evaluate effects of streambank fencing on surface and near-stream ground water quality	◆Paired watershed 1 control / 1 treatment ◆Upstream/downstream

PROJECT	SAMPLING SCHEME	PRIMARY WATER QUALITY VARIABLES
Michigan: Sycamore Creek Watershed	◆Automated storm events (Mar. - July) ◆Weekly grab samples (Mar. - July) ◆Automated flow-proportional sampling year-round at watershed outlet	◆Turbidity, TSS, TP, OP, TKN, NH_3, NO_2+NO_3, COD
Minnesota Whitewater River Watershed	◆Automated event and weekly chemistry ◆Annual biomonitoring	Temperature, TSS, TP, NO_3, fecal coliform, macroinvertebrates, fish, and habitat
Nebraska: Elm Creek Watershed	◆Grab sampling: weekly (April - Sept.), monthly (Oct. - March) ◆Seasonal biomonitoring, habitat assessment	Temperature, DO, TSS, macroinvertebrates, fish, stream morphology, substrate, habitat
New York: New York City Watershed	◆Automated storm event sampling ◆Weekly grabs during base flow ◆Twice/monthl pathogens ◆Annual biomonitoring	TSS, TP, SRP, TDP, PP, TKN, NH_3-N, NO_2+NO_3-N, TOC, pH, *Cryptosporidium, Giardia,* macroinvertebrates
North Carolina: Long Creek Watershed	◆Grab sampling: weekly (Dec. - May), monthly (June - Nov.) ◆Automated storm event sampling ◆Annual biological survey	TS, TSS, TP, TKN, NO_2+NO_3-N, DO FC, FS, macroinvertebrates, aufwuchs
Oklahoma: Peacheater Creek	◆Grab sampling: weekly (July - Jan.), monthly (Feb. - June) ◆Automated storm event sampling ◆Biomonitoring: 2x/yr (periphyton and macroinvertebrates), annual to biennial (fish and habitat)	Turbidity, TSS, TP, OP, TKN, NO_2+NO_3-N, Periphyton, macroinvertebrates, fish habitat, bank erosion
Oregon: Upper Grande Ronde Basin	April - October monitoring season: ◆Continuous water temperature ◆Water chemistry, habitat, biomonitoring 3x/year	Water temperature, DO, turbidity, BOD NH_3, macroinvertebrates, fish, habitat
Pennsylvania: Pequea and Mill Creek Watersheds	◆Continuous flow measurement ◆Paired watersheds: grab samples every 10 d (Apr. - Nov.), monthly (Dec. - Mar.) ◆Upstream/downstream: automated storm even sampling ◆Biomonitoring 2x/yr	SS, NH_3, NO_2+NO_3, organic N, TP, OP, habitat, macroinvertebrates

BMPs	MAJOR COOPERATING INSTITUTIONS	PROJECT TIME FRAME
◆Reduced tillage ◆Cropland protective cover ◆Diversions ◆Water and sediment control structures ◆Streambank stabilization	◆Ingham Co. Soil Conservation District ◆MI Dept. of Natural Resources ◆MSU Extension - Ingham Co. ◆USDA-NRCS	1993 - 1997 annual reports
◆No-till/conservation tillage ◆Grazing management ◆Livestock exclusion ◆Nutrient and pest management ◆Stream buffers	◆MN Pollution Control Agency ◆Whitewater River Watershed Project ◆University of Minnesota ◆Winona State University	1994 - 2006
◆Filter strips ◆Streambank stabilization ◆Vegetative cover ◆Livestock exclusion/range management ◆Conservation tillage ◆Irrigation management	◆NE Department of Environmental Quality ◆USDA NRCS (HUA Project) ◆Webster County Cooperative Extension	1992 - 1996 annual HUA reports
◆Manure storage/management ◆Barnyard runoff management ◆Milkhouse waste diversion ◆Livestock exclusion ◆Cropland erosion control ◆Nutrient management	◆NY State Dept. Env. Cons. ◆NY City Dept. Env. Protection ◆NYS Watershed Agricultural Council ◆Delaware County Soil and Water Cons. District ◆USDA-NRCS	1993 - 2006
◆Cropland erosion controls ◆Nutrient management ◆Waste storage structures ◆Livestock exclusion/pasture management	◆Gaston Co. Cooperative Extension ◆NCSU Water Quality Group ◆NC DNR Div. of Water Quality ◆NC Cooperative Extension	1993-2001 Final Report 2002
◆Riparian buffers, fencing ◆Planned grazing/pasture management ◆Animal waste management, structures ◆Watering facilities ◆Critical area vegetation ◆Nutrient management	◆OK Conservation Commission ◆Co. Conservation Districts ◆Co. Extension Service ◆OK State University ◆USDA NRCS	1995-2005 Implementation Report 2005
◆Stream channel diversion/restoration ◆Streambank stabilization ◆Riparian revegetation	◆OR Dept. Environmental Quality ◆Local SWCDs ◆Confederated Tribes of Umatilla Indian Reservation (CTUIR) ◆US Forest Service ◆USDA NRCS	1993-2006 annual and periodic reports
◆Streambank fencing on all pasture land adjacent to stream	◆PA DEP Bureau of Land and Water Conservation ◆USGS ◆USDA NRCS ◆Lancaster Conservation District ◆PSU Cooperative Extension	1993 - 2001 Final Report 2005

PROJECT	BASIN SIZE	IMPAIRMENT(S)	POLLUTANT(S)
Pennsylvania: Stroud Preserve Watershed	0.3 mi^2	Regional WQ impairments: ◆Recreation ◆Aquatic life support	◆Nutrients ◆Sediment
Pennsylvania: Swatara Creek Watershed	43 mi^2	◆Aquatic life support ◆Recreation ◆Metals	◆Acidity ◆Sulfates
Pennsylvania: Villanova University Stormwater BMPs	<0.5 mi^2	Regional stormwater issues, e.g., ◆Aquatic life support ◆Recreation ◆Water Supply	◆Flow ◆Sediment ◆Nutrients ◆Bacteria ◆Metals
South Dakota: Bad River	3,209 mi^2	◆Aquatic life support ◆Recreation ◆Irrigation	◆Sediment ◆Loss of channel capacity ◆Loss of water clarity
Vermont: Lake Champlain Basin Agricultural Watersheds	12 mi^2	◆Aquatic life support ◆Recreation ◆Downstream impacts to Lake Champlain (Eutrophication)	◆Nutrients (P) ◆Bacteria ◆Organic matter
Washington: Totten and Eld Inlet	105 mi^2	◆Shellfish harvesting	◆Bacteria
Wisconsin: Otter Creek	26 mi^2	◆Aquatic life support ◆Recreation ◆Downstream impacts to Sheboygan River and lake Michigan	◆Nutrients (P) ◆Bacteria ◆Sediment ◆Loss of habitat

POLLUTANT SOURCE(S)	WATER QUALITY OBJECTIVES	WATER QUALITY MONITORING DESIGN
◆Cropland ◆Fertilizers ◆Atmospheric deposition	◆Evaluate nps pollutant reduction by riparian forest buffer ◆Assess time required to achieve significant pollution reductions ◆Establish specific guidelines for development and management of rfb in mid-Atlantic region	◆Paired watershed 1 control/1 treatment
Coal mine drainage	◆Evaluate performance of innovative passive treatment systems for neutralizing coalmine drainage and iron removal ◆Evaluate long-term effects on stream water quality	◆Upstream/downstream ◆Single station before/ after
Urban stormwater, i.e. impervious surfaces	◆Test and evaluate performance of individual stormwater BMPs to reduce peak flows and treat water quality	◆Input/output from BMPs
◆Cropland ◆Rangeland ◆Grazing practices ◆Hydropower generation	Document water quality improvements achieved through implementation of riparian and rangeland management BMPs	◆Paired watershed 1 control / 1 treatment ◆Before/after
◆Livestock access to streams ◆Degraded streambanks and riparian zones ◆Dairy operations ◆Cropland	Assess effectiveness of livestock exclusion/ riparian restoration: ◆Document changes in nutrients, bacteria, and sediment concentrations and loads ◆Evaluate response of stream biota	◆Paired watershed 1 control / 2 treatment
◆Livestock operations in stream corridors ◆Failing on-site wastewater treatment systems	◆Reopen restricted shellfish areas and protect threatened shellfish areas ◆Reduce median FC levels in tributary streams by 44-69%	◆Paired watershed 1 control / 1 treatment ◆Watershed outlet trend stations
◆Dairy operations ◆Cropland ◆Streambank erosion	◆Increase numbers of pollution-intolerant fish species ◆Improve recreational uses ◆Reduce pollutant loading to the Sheboygan River and Lake Michigan	◆Paired watershed 1 control / 1 treatment ◆Above/below ◆Watershed outlet station

PROJECT	SAMPLING SCHEME	PRIMARY WATER QUALITY VARIABLES
Pennsylvania: Stroud Preserve Watershed	◆Grab samples 2x/month ◆Storm events 8x/year ◆Overland flow 4x/yr ◆Groundwater quarterly	SS, dissolved N, dissolved P, Dissolved Organic Carbon, Chloride, conductivity
Pennsylvania: Swatara Creek Watershed	◆Continuous flow, pH, temperature ◆Storm event sampling	pH, acidity, alkalinity, DO, SS, TP, TN, NH_3, NO_2+NO_3, metals, fish, macroinvertebrates
Pennsylvania: Villanova University Stormwater BMPs	◆Automated storm event monitoring for infiltration BMPs ◆Automated event monitoring and grab sampling of baseflow for stormwater wetland	Flow, temperature, turbidity, TSS dissolved P, N, metals, FC
South Dakota: Bad River	◆Automated storm event monitoring ◆24-hr composites during spring snowmelt period (daily to weekly)	Flow, TSS
Vermont: Lake Champlain Basin Agricultural Watersheds	◆Continuous flow measurement ◆Automated flow proportional composite samples (weekly) ◆Grab sampling (2x/week) ◆Annual biomonitoring	TSS, turbidity, TP, TKN, *E. coli*, FC, FS, macroinvertebrates, fish
Washington: Totten and Eld Inlet	◆Grab sampling: weekly (Nov. - April), ◆Storm event sampling (6x/yr)	FC, TSS, turbidity
Wisconsin: Otter Creek	Monitoring season: April - October ◆Grab sampling ~ weekly ◆Storm event monitoring ◆Annual biomonitoring	TP, dissolved P, TKN, NH_3, NO_2+NO_3, TSS, turbidity, FC, fish, macroinvertebrates, habitat

BMPs	MAJOR COOPERATING INSTITUTIONS	PROJECT TIME FRAME
◆Three-zone riparian forest buffer	◆Stroud Water Research Center ◆PA Dept. Environ. Protection ◆Chesapeake Bay Program ◆USDA NRCS ◆USDA Forest Service	1992 - 2007
◆Limestone sand dosing ◆Open limestone channels ◆Diversion wells ◆Limestone drains	◆USGS ◆PA DEP Bureau of Mining and Reclamation ◆Schuykill Co. Cons. Dist. ◆Northern Swatara Creek Watershed Association	1998 - 2007 periodic reports
◆Bio-infiltration traffic island ◆Porous concrete infiltration ◆Infiltration trench ◆Stormwater wetland	◆Villanova University Urban Stormwater Partnership ◆PA DEP	2003 - 2010 periodic reports
◆Riparian management ◆Rangeland/grazing management	◆SD Dept. of Environment and Natural Resources ◆USDA-NRCS ◆Upper Bad River Task Force ◆East Pennington Conservation District	1996 - 2006
◆Livestock exclusion ◆Bio-engineering streambank stabilization	◆Univ. of VT School of Natural Resources ◆VT Dept. Environ. Cons. ◆USDA NRCS ◆USDA FWS	1994-2000 Final Report 2001
◆Pasture/grazing management ◆Stream fencing ◆Riparian buffers ◆Animal waste management ◆Runoff management ◆Repair failing on-site wastewater systems	◆WA Dept. of Ecology ◆Thurston Co. Env. Health Serv. ◆Thurston Cons. District ◆USDA NRCS	1993 - 2002 Final Report 2003
◆Streambank stabilization ◆Livestock fencing ◆Barnyard runoff management ◆Reduced tillage ◆Nutrient and pesticide management	◆WI Dept. Natural Resources ◆USGS ◆Sheboygan Co. Land Conservation Dept. ◆UW Extension	1994 - 2003 Final Report 2005