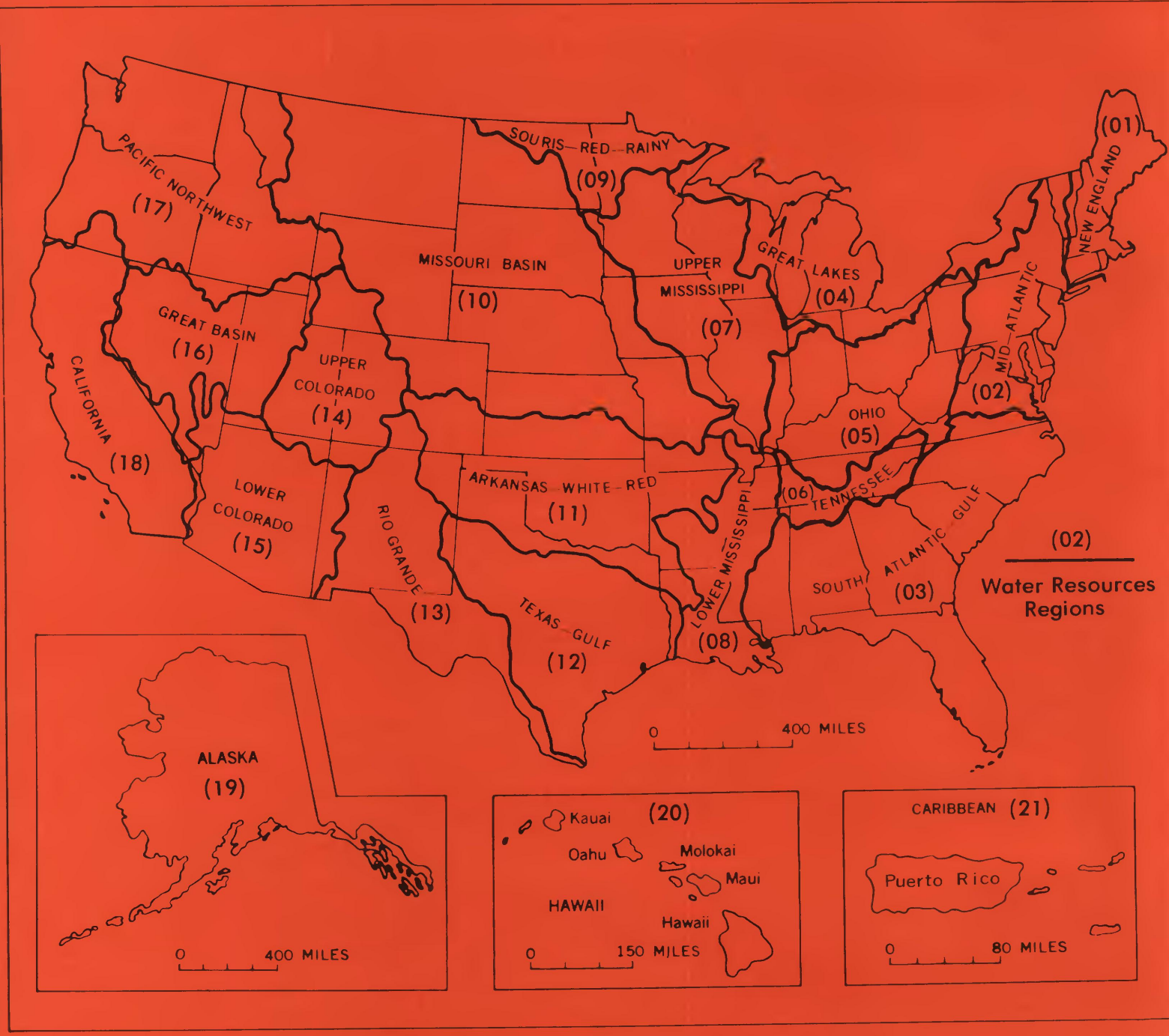
INTERAGENCY ADVISORY COMMITTEE ON WATER DATA

NOTES ON SEDIMENTATION ACTIVITIES CALENDAR YEAR 1978

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
OFFICE OF WATER DATA COORDINATION
RESTON, VIRGINIA 22092



Water Resources Regions of the United States

NOTES ON SEDIMENTATION ACTIVITIES CALENDAR YEAR 1978

Prepared by
U.S. DEPARTMENT OF AGRICULTURE
Science & Education Administration

Agricultural Research
for the
Subcommittee on Sedimentation
of the
INTERAGENCY ADVISORY COMMITTEE ON WATER DATA

U.S. DEPARTMENT OF THE INTERIOR
Geological Survey
Office of Water Data Coordination
Reston, Virginia 22092

January 1980

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Preface

The need for disseminating current information on activities in the field of sedimentation was proposed by the Chairman of the Federal Interagency River Basin Committee's Subcommittee on Sedimentation shortly after the subcommittee was formed in May 1946. At the fifth meeting of the subcommittee on September 17, 1946, the members approved this proposal and agreed to the issuance of the quarterly report as one means of effecting better coordination of the work of various Federal agencies in the field of sedimentation.

Quarterly reports were issued during the period of July 1, 1946, through June 30, 1947, when the reporting period was changed to a 6-month period, and semiannual reports were issued through 1953. Starting in 1954 and continuing through the present, these reports have been made annually and cover the activities of the Federal agencies in the field of sedimentation on the calendar year basis.

This report is a digest of information furnished by Federal agencies conducting sedimentation investigations on work in progress or planned, important findings, new methods, new publications, laboratory and other research activities, and other pertinent information. The material has been organized by major drainage regions in the conterminous United States, Alaska, Hawaii, Puerto Rico, and foreign. There is also a section on Research and Other Activities.

In the past, each issue of "Notes on Sedimentation Activities" contained a list of stations at which sediment data have been obtained giving the station location, drainage area, and other related information. Because the station list does not change significantly from year to year, the decision was made to include the listings every other year in the interest of economizing. Therefore, the station list in the 1977 issue is considered to be still current. An updated station listing will be included in the 19~~8~~ 79 issue.

Information for "Notes on Sedimentation Activities" for calendar year 1978 was contributed by the representatives of participating Federal agencies. Suggestions for improving the report, both in content and in format, are welcome.

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AGENCIES REPRESENTED ON THE SUBCOMMITTEE ON SEDIMENTATION
INTERAGENCY ADVISORY COMMITTEE ON WATER DATA

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* Forest Service
* Science and Education Administration
*Soil Conservation Service

DEPARTMENT OF THE ARMY
*Corps of Engineers

DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

DEPARTMENT OF ENERGY
Federal Energy Regulatory Commission

DEPARTMENT OF THE INTERIOR
Bureau of Mines
*Bureau of Reclamation
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DEPARTMENT OF TRANSPORTATION
*Federal Highway Administration

*TENNESSEE VALLEY AUTHORITY

*Participating agencies in "Notes on Sedimentation Activities"

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NEW ENGLAND REGION

CORPS OF ENGINEERS

New England Division

Report on sedimentation and erosion activities in the New England Division is as follows:

1. Black Rock Lake, CT. Approximately 2,900 c.y. of sediment was removed in the fall 1978 (FY 79) from the same area that had 4,600 c.y. removed in 1975. Most of the sediment was accumulated since 1975. Plans and specifications are being implemented for the restoration and reforestation of a large borrow area which is the major contributor to lake sedimentation. Reforestation is nearing completion with 8,000 trees planted so far with another 2,000 planned for spring 1979. Additional sedimentation removal will be budgeted for in FY 84 and every five years if necessary.

2. Northfield Brook Lake, CT. Fall 1979 (FY 80) drawdown planned for the removal of 2,000 to 3,000 c.y. of sediment from the 8-acre lake. Problems caused by off-reservoir sources of sediment have declined. Reforestation and erosion control measures to slow erosion from the lake's major sediment contributor, the borrow area, have been completed (spring 1978).

3. Hop Brook Lake, CT. A complete approach to sediment and water quality problems at Hop Brook's 21-acre lake has been implemented to reduce sediment, improve the water resource, fishery and recreational value: Under the provisions of a contract awarded this past fall, covering the sale of 160,000 c.y. of sand and gravel, the buyer has commenced work on a long-term, overall deepening and lake bed restructuring project to our specifications.

4. Thomaston Dam, CT. Sediment accumulated from past storage in this drybed reservoir is being removed through agreement with the Town of Thomaston for landfill use. Brush and debris which trap sediment have been removed through annual maintenance.

5. North Hartland Lake, VT. Silt has accumulated in lakeshore areas as a result of bank slumping associated with storage operations. The feasibility of removing this sediment is being evaluated.

6. North Springfield Lake, VT. Sedimentation at the confluence of the Black River's North Branch and the recreation pool at Stoughton Pond will be removed after a plan for draining the pool is finalized. The ogee weir that serves as the pool's outlet must be modified. Routine maintenance may then be applied to the silt removal.

7. Otter Brook Lake, NH. Annual silt removal is scheduled to handle approximately 1,500 c.y. per year.

8. Townsend Lake, VT. Annual silt removal is budgeted for accumulations around the beach area. Debris removal from below the log boom is scheduled for FY 81. Accumulations around the boat ramp are being studied for possible removal through sale or contract.

9. Littleville Lake, MA. Sedimentation along the channel from the Dayville Boat Ramp to the Lake has not yet been removed. An estimated 45,000 c.y. of sediment have filled the 300 to 400 foot long, 50 foot wide channel to a depth of 3 feet. Turbidity and boating problems have resulted. Budget request has been submitted for approval for FY 81 removal.

NEW ENGLAND REGION

GEOLOGICAL SURVEY

St. John Subregion

1. Suspended-sediment data are being collected on a monthly basis at Aroostook River at Caribou, Maine, as a part of the National Stream Quality Accounting Network (NASQAN).

Penobscot Subregion

1. Suspended-sediment data are being collected on a monthly basis at Penobscot River at West Enfield, Maine, as a part of NASQAN.

Androscoggin Subregion

1. Suspended-sediment data are being collected on a monthly basis at Kennebec River at Bingham, Maine, and at Androscoggin River at Brunswick, Maine, as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis for the U.S. Corps of Engineers at Wild River at Gilead, Maine, as a part of the National Hydrologic Benchmark Network.

Maine Coastal Subregion

1. Suspended-sediment data are being collected on a monthly basis at St. Croix River at Milltown, Maine, as a part of NASQAN.

Saco Subregion

1. Suspended-sediment data are being collected on a monthly basis at Saco River at Cornish, Maine, as a part of NASQAN.

Merrimack Subregion

1. Suspended-sediment data are being collected on a monthly basis at Merrimack River above Lowell, Mass., as a part of NASQAN.

Connecticut Subregion

1. Suspended-sediment data are being collected on a monthly basis at Connecticut River at North Walpole, N.H., and at Connecticut River at Thompsonville, Conn., as a part of NASQAN.

Massachusetts-Rhode Island Coastal Subregion

1. Suspended-sediment data are being collected on a monthly basis at Charles River at Charles River Village, Mass., as a part of NASQAN.

Connecticut Coastal Subregion

1. Suspended-sediment data are being collected on a monthly basis at Yantic River at Yantic, Conn., at Black River at Coventry, Vt., and at Housatonic River at Stevenson, Conn., as a part of NASQAN.

Special Studies

1. Suspended-sediment data are being collected on approximately a monthly basis at three sites in the Norwalk River valley in cooperation with the town of Wilton, Conn.

2. Suspended-sediment data were obtained on a storm event basis at twenty-seven sites in the Lake Waramaug drainage basin, as part of a study to obtain water-quality information to be used in the development of a lake management program. The study is being done in cooperation with the Northwest Connecticut Regional Planning Agency.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
135 High Street, Room 235
Hartford, CT 06103

District Chief, WRD
U.S. Geological Survey
150 Causeway Street, Suite 1001
Boston, MA 02114

NEW ENGLAND REGION

SOIL CONSERVATION SERVICE

The SCS staff assisted the Connecticut Council on Soil and Water Conservation complete a statewide inventory of active potentially major sediment sources. This basic data is being evaluated by regional planning agencies to estimate the sediment problems in each of the 308 "third-order" streams of Connecticut for the State "208" Water Quality Plan.

SCS-SWCD has preliminary data on sediment yield for six small watersheds as a result of SEDEL (Sediment Delivery Computer Program) output predictions.

An interagency effort resulted in the installation of a new sediment sampling station in the Little River Watershed, Windham County, Connecticut.

MID ATLANTIC REGION

CORPS OF ENGINEERS

North Atlantic Division

Baltimore District

The following data are on accumulated sediment, collected during 1978. The data are records of the material removed during routine maintenance of flood control projects.

Project Location	Stream	Sediment Removal	Sediment Removed During 1978 (CU YDS)
Almond Dam	Canacadea, Cr.	Rt. 21 Br.	1,400
Arkport Dam, NY	Canisteo River	Intake channel	5,947
Binghampton, NY	Pierce Creek	Lower channel and confluence with Susquehanna River	890
Canisteo, NY	Purdy Creek	Check Dam	5,302
		Check Dam Bucket	1,096
		Channel	3,248
		Confluence with Bennett Cr.	2,123
Corning, NY	Cutler Creek	Above upper drop structure	1,500
		Outlet of twin conduits	414
Hornell, NY	Chauncey Run	Confluence with Canisteo River	448
	Crosby Creek	Between Check dam and paved channel	256
		Check Dam and channel upstream	2,304
Lisle, NY	Dudley Creek and Tioughnioga River	Channel at confluence	575
Whitney Point,NY	Tioughnioga River	Channel	896

New York District

The District conducted sediment tests at the following locations:

Project Name	3-Phase Bioassay***	Grain Size
Gowanus Creek Channel*	X	X
Westchester Creek*	X	X
Hudson River Channel*	X	X
Elizabeth River**	X	X
Newtown Creek*	X	X
Newark Bay*	X	X
Mamaroneck Harbor*	X	X
Bay Ridge Channel	X	X
NY-NJ Channels*	X	X
Raritan River*	X	X
Portchester Harbor*	X	X
Red Hook Channel*	X	X
Passaic River*	X	X

*Navigation Project
**Flood Control Project
***The bioassay of appropriate sensitive marine organisms can be used as an aid in evaluating the importance of dissolved chemical constituents released from the sediment during disposal operations. This procedure can also be used to evaluate the effect of suspended particulate matter that is present in the water column for certain periods of time during disposal of dredged material. A series of experimental treatments and controls are established using the liquid phase or suspended particulate phase of the dredged material and disposal site water. The test organisms are added to the test chambers and incubated under standard conditions for a prescribed period of time. The surviving organisms are examined at appropriate intervals to determine if the test material is producing an effect.

Philadelphia District

District sedimentation activities during 1978 were as follows:

1. Continued financial support of the United States Geological Survey for the collection of sediment data at:

(a) Delaware River at Trenton, New Jersey

(b) Schuylkill River at Berne, Pennsylvania

(c) Schuylkill River at Philadelphia, Pennsylvania

(d) Tulpehocken Creek at Blue Marsh Damsite-Pre-Impoundment Studies

2. Initiation of up-dated sediment surveys of District reservoir projects:

(a) F.E. Walter Reservoir

(b) Prompton Lake

(c) Beltzville Lake

FOREST SERVICE

George Washington National Forest in Virginia. Stream from 13 areas were monitored for turbidity.

Stream erosion was controlled in Hawes Run (Brandywine Recreation Area).

Rehabilitated 9 acres of the old Midvale mine which was abandoned in the late 50s. This resulted in a reduction of about 1,000 tons of sediment annually.

MID ATLANTIC REGION

GEOLOGICAL SURVEY

Richelieu Subregion

1. Suspended-sediment data are being collected on a periodic basis at Richelieu River (Lake Champlain) at Rouses Point, N.Y., as a part of NASQAN.

Upper Hudson Subregion

1. Suspended-sediment data are being collected on a daily basis at Hudson River at Waterford, N.Y., for the town of Waterford. Sediment data are also being collected on a daily basis at Mohawk River at Cohoes, N.Y., at Hudson River at Schuylerville, N.Y., and at Hudson River at Stillwater, N.Y., in cooperation with the New York State Department of Environmental Conservation.

2. Suspended-sediment data are being collected on a periodic basis at Hudson River at Glens Falls, N.Y., in cooperation with the New York State Department of Environmental Conservation.

3. Suspended-sediment data are being collected on a periodic basis at Hudson River at Green Island, N.Y., as a part of NASQAN.

4. Suspended-sediment are being collected on a periodic basis at Esopus Creek at Shandaken, N.Y., as a part of the National Hydrologic Benchmark Network.

Lower Hudson-Long Island Subregion

1. Suspended-sediment data are being collected at Rariton River near South Bound Brook, N.J., at Peconic River at Riverhead, N.Y., and at Nissequoque River near Smithtown, N.Y., as a part of NASQAN.

Delaware Subregion

1. Suspended-sediment data are being collected on a monthly basis at Toms River near Toms River, N.J., and West Branch Wading River at Maxwell, N.J., and on a daily basis at Delaware River at Trenton, N.Y., as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at McDonalds Branch in Lebonon State Forest, N.J., as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a daily basis at Brandywine Creek at Wilmington, Del., in cooperation with the Delaware Geological Survey.

4. Suspended-sediment data are being collected on a daily basis at two sites on the Schuylkill River, Berne and Philadelphia, (Manayunk) Pa. The data will be anaylzed by the U. S. Corps of Engineers to evaluate the Delaware River dredging programs. Sediment data are also being collected on a daily and storm basis on Schuylkill River near Landingville, Penn., to determine storm and daily sediment discharge rates.

Susquehanna Subregion

1. Suspended-sediment data are being collected on a monthly and storm event basis at Young Womens Creek near Renovo, Pa, as part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected at Juniata River at Newport, Pa., as a Federal sediment index station.

3. Suspended-sediment data are being collected on a daily basis at Tioga River at Lindley, N.Y., and the Chemung River at Chemung, N.Y., in cooperation with the Susquehanna River Basin Commission.

4. Suspended-sediment data are being collected at Suatara Creek at Harper Tavern, Penn., and Susquehanna River at Harrisburg, Penn.

Upper Chesapeake Subregion

1. Suspended-sediment data are being collected on a montly basis at Choptank River near Greensboro, Md., and at Patuxent River near Bowie, Md., as a part of NASQAN.

Potomac Subregion

1. Suspended-sediment data are being collected on a daily basis at North Branch Potomac River near Cumberland, Md., and at Monacacy River at Reich's Ford Bridge near Frederick, Md., in cooperation with the Maryland Geological Survey.

2. Suspended-sediment data are being collected on a daily basis at Cononcocheaque Creek at Fairview, Md., and at Potomac River at Point of Rocks, Md., as a part of the Federal CBR program.

3. Suspended-sediment data are being collected on a monthly basis at Lost River at McCauley near Baker, W. Va., for the U.S. Soil Conservation Service.

4. Suspended-sediment data are being collected at Potomac River at Chain Bridge, Washington, DC, as a part of NASQAN.

5. Suspended-sediment data are being collected on a daily basis at Snakeden Branch at Reston, Ba., with an automatic sampler to provide information of sediment transport during high flow.

Lower Chesapeake Subregion

1. Suspended-sediment data are being collected on a daily basis on Rappahanock River at Remington, Va., as A Federal sediment index station.

Special Studies

1. A study of non-point sources of sediment, nutrients, and pesticides was started during the 1977 water year in the Pequea Creek Basin in Lancaster County, Pennsylvania. Data collection which continued through the 1978 water year includes the operation of an automatic suspended-sediment sampler on the Pequea Creek at Martic Forge and the collection of data from six subbasin sites during storm events. The study is in cooperation with the Susquehanna River Basin Commission, and has the support of the Chesapeake Bay Program.

2. Automatic sediment samplers were also installed at three sites in Northern Pennsylvania during 1978. The samplers were installed as part of a study to evaluate the effects of surface mining operations on the Babb Creek basin. The study is in cooperation with USGS-OACR.

3. The basic suspended-sediment sampling network established by the New Jersey District is carried out in cooperation with the U.S. Corps of Engineers, N.J. Department of Environmental Protection, and the N.J. Department of Agriculture, Soil Conservation Service. A computer printout is available upon request which lists:

(1) for each water year, the suspended-sediment stations established and the type of suspended-sediment data collected for each station;

(2) all of the stations in New Jersey where suspended-sediment data have been collected and the type of suspended-sediment data for each year when sampled;

(3) a list of reports dealing with suspended-sediment loads in New Jersey.

Requests for the Computer printout should be sent to:

District Chief, WRD
U.S. Geological Survey
P.O. Box 1238
Trenton, N.J. 08607

4. Collection of sediment data was obtained at the Coastal Plain Index Station at Great Egg Harbor River at Folsom, N.J., normally at a frequency of twice weekly and twice daily during runoff conditions. This work is being done as part of the Federal Collection of Basic Records to determine trends and the general hydrologic conditiona.

For additional information about Geological Survey activities within this region, contact the following offices:

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Room 3017
500 Quarrier Street
East Charleston, WV 25301

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U.S. Geological Survey
P.O. Box 1350
U.S. Post Office and
Courthouse Building, Room 343
Albany, NY 12201

District Chief, WRD
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200 Grace Street, Room 304
Richmond, VA 23220

SOIL CONSERVATION SERVICE

Studies of sediment damages and determinations of sediment yields were made for the Upper Chester River watershed in Kent and Queen Anne Counties, Maryland, and Kent and New Castle Counties, Delaware.

Reconnaissance surveys of two reservoirs were performed to obtain estimates of average annual sediment yield and total sediment accumulation of coastal plain soils for use in Resource Conservation and Development (RC&D) programs. Sunset Lake, on the Cohansey River, and Mary Elmer Lake on Irelands Mill Stream, both in Cumberland County, near Bridgeton, New Jersey, were surveyed.

Sunset Lake, drainage area 45.7 mi^2, was built in 1814. The estimated original capacity is 428.6 acre feet; total sediment volume, measured in 1978, is 140.6 acre feet. The long-term sediment yield is 0.86 acre feet per year. At a dry density of 66 pcf, this amounts to about 27.1 tons per square mile per year. The present surface area of the reservoir is 88.9 acres.

Mary Elmer Lake, drainage area 4.8 mi^2, was also built in 1814. Its estimated original capacity is 99.8 acre feet; total sediment volume, measured in 1978, is 27.4 acre feet. The long-term sediment yield is 0.17 acre feet per year. At a dry density of 67 pcf, this amounts to about 50.8 tons per square mile per year. The present surface area of the reservoir is 16.7 acres.

SOUTH ATLANTIC-GULF REGION

CORPS OF ENGINEERS

South Atlantic Division

Charleston District

The sedimentation ranges at W. Kerr Scott Dam and Reservoir, Yadkin River, N.C. were resurveyed during 1978. They were last surveyed in 1971. Initially, only selected ranges were resurveyed to determine the amount of additional sediment that had occurred in the reservoir following the flood of November 1977, a flood that produced a record pool elevation at the project. The initial survey revealed more sediment than was anticipated; therefore, it was decided to resurvey all the ranges. The equipment used in this survey were a Carl Leiss N1-2 level, 1/8" stainless steel cable graduated every 20 feet, and a 14-foot aluminum flat bottom boat with an ES-130-SS Bludworth depth recorder. In November 1978, when the reservoir was drawn down because of drought conditions to about 10 feet below the normal pool level, both ground level and aerial photos were taken of exposed sediment deposit areas. The resurveyed ranges have been plotted and a new reservoir capacity curve is being computed. Data will be further analyzed and a report will be prepared during the latter part of FY 79.

Jacksonville District

Sediment load measurements were made monthly on Rio Bucana and Rio Portugues Basins in Puerto Rico and intermittently on St. Lucie Canal in Florida.

Mobile District

Sedimentation Range Network Monitoring

1. The sedimentation range networks in the Demopolis and Gainesville Projects were resurveyed during the year. These projects are located on the Tombigbee River and form a part of the Tennessee-Tombigbee Waterway.

2. In addition, supplemental ranges were established in several bendways of the two projects. These ranges were also resurveyed during 1978.

3. Complete network resurveys of the projects will be made at six month intervals to provide data for a cooperative planning study that is being conducted by this office and the Waterways Experiment Station at Vicksburg, Mississippi.

Sedimentation Design Memoranda

1. The sedimentation design memorandum for the Columbus Lock and Dam project was completed and approved on 28 July 1978. The original survey of the range network was initiated late in the year.

2. Work has progressed during 1978 on the sedimentation design memorandum for the Aberdeen Lock and Dam project. This memorandum is the fourth in a series of five sedimentation design memoranda for the Tennessee-Tombigbee Waterway.

Sedimentation Studies

1. A sedimentation study of Valley Creek and a five mile reach of the Black Warrior River adjacent to the mouth of the creek was begun during the year. The purpose of the study is to determine the source, extent and quantity of the abnormal deposition observed in the area.

2. Two on-going studies to determine the natural sedimentation characteristics of the areas were intensified during the year. The areas, which are located in Mississippi, are the Tibbee River and its tributaries and Twenty-mile Creek.

3. The Daniel Creek study was concluded during the year and resulted in an out-of-court settlement with stripmining interests operating in the basin.

4. During 1978 an analysis was begun to determine the erosion rates, deposition patterns and predicted future effects to six Alabama Power Company dams, adjacent to which locks are to be constructed for the proposed Coosa River Waterway project.

Suspended Sediment Investigations

1. During the year data were obtained on a daily basis from five locations. Four stations, Columbus, Aberdeen, Amory and Fulton are located on the Tombigbee River in Mississippi. The remaining station, Claiborne, Alabama is located on the Alabama River. Additionally, suspended sediment samples were obtained at about five week intervals at 18 stations located in the Tombigbee River basin. Eight stations were discontinued during 1978 and were located in the Tombigbee River basin. Three stations, Barrs Ferry, Ironwood Bluff and Beans Ferry were on the Tombigbee River. Two stations, Prairie and Buena Vista, were on Chuquatonchee Creek. North Abbott and Trebloc were on Houlka Creek and Mayhew was on Catalpa Creek.

2. Plans were made during 1977 to install permanent suspended sediment monitors on all existing and planned dams on the Tombigbee River. In addition, a monitor is also planned for the Oliver Lock and Dam on the Black Warrior River, a large tributary to the Tombigbee River. This network of sampling stations is being installed to monitor the post-project sedimentation effects of the Tennessee-Tombigbee Waterway. The fabrication of the samplers is in progress and installation will begin on the existing structures as soon as possible.

Savannah District

Harbor Investigation. During dredging operations in Savannah Harbor, the chemical characteristics of sediment samples were determined before and during dredging to develop criteria for predicting the effects on water quality for dredging a particular type sediment. In order to observe in detail the water quality changes during dredging, samples of the water sediment suspension were analyzed directly from the dredge discharge pipe, the effluent from the weir of the diked spoil confinement area, and the water quality in the vicinity of the dredge.

In Savannah Harbor, monthly profiles were made with the fathometer to determine the locations of sediment deposits in the channels and sediment basin.

In order to determine the rate of shoaling and to schedule dredging operations in East River, Brunswick Harbor, hydrographic surveys were made at intervals of about one month, and before and after each maintenance dredging. These surveys were made with the fathometer and soundings were taken with an eight pound disc lead in conjunction with each survey to insure consistent interpretation of the fathograms.

Suspended Sediment. Sediment index-range resurvey in the upper reaches of Clark Hill and Hartwell Reservoirs will be completed by 1 September 1979. Five suspended sediment stations in the river basins and harbor within the District were deleted in 1978 because of manpower limitations and fund restrictions. It appears that three selected stations will be reestablished during 1979 and 1980.

Other Investigations. Approximately sixty-five borings and/or "vibra-core" samples were taken along 23 miles of channel in the inner Savannah Harbor and along 10 miles of the harbor entrance channel. These are being used to determine the composition of bed material at depths varying from 20 to 60 feet below mean low water. An additional 23 samples were taken offshore near Tybee Island to locate suitable material for beach renourishment.

Wilmington District

Sedimentation Surveys.

1. John H. Kerr Dam and Reservoir, Roanoke River, VA and NC. The sedimentation ranges at Kerr were resurveyed during 1976 in order to determine the amount of storage lost to sedimentation since the last survey was made in 1959-60. Equipment used was a 17-foot fiberglass boat, a Raytheon Model 719-B Fathometer with narrow beam transducer, an Interspace Technology Model 412 Digitizer, a Systron-Donner Model 5103 digital printer and a Tellurometer Model CA-1000-D range meter. Data will be analyzed and a report prepared. When adjustments are made in the reservoir capacity curve, the dependable capacity of the project will be redetermined and power sales contracts modified to reflect the new dependable capacity.

2. Philpott Lake, Smith River, VA. The sedimentation ranges at Philpott were resurveyed during 1976 in order to determine the amount of storage lost to sedimentation since the last resurvey was made in 1960. Equipment was the same as listed for John H. Kerr. Data are being analyzed and preparation of a report on the resurvey is underway. The report should be completed in 1979. The dependable capacity of Philpott will be redetermined, if necessary, but not until both Kerr and Philpott can be redetermined together.

3. Sediment Load Measurement. Two suspended sediment sampling stations (at Randolph, Virginia on Roanoke River and at Paces, Virginia on Dan River) upstream from John H. Kerr Reservoir were operated. The data (suspended sediment, particle size, chemical analysis and temperature) were used in connection with operation and maintenance of John H. Kerr Reservoir Project.

SOUTH ATLANTIC-GULF REGION

FOREST SERVICE

National Forests in Alabama. Stream flow was monitored on six timber management activities to determine the effect, if any, on water quality. The Forest has two model 1680 ISCO samplers for use in the water quality study.

Rehabilitation work was completed on 24 acres of eroding forest lands resulting in an annual decrease of approximately 1,000 tons of sediment. In addition, emergency burned area rehabilitation was completed on about 200 acres of the Columbus fire. An inventory of the restoration needs was updated.

The Forest Hydrologist served on the 208 Policy Advisory Committee assisting in the preparation of the State silvicultural nonpoint pollution portion of the 208 water quality plan.

Chattahoochee-Oconee National Forest in Georgia. The Forest completed restoration work on 75 acres of eroding forest lands. This resulted in sediment reduction of approximately 3,500 tons annually. Burned area emergency rehabilitation was also completed on about 70 acres of the Mt. Airy Fire.

The Forest Soil Scientist served as a technical member of the 208 silvilcultural task force assisting in developing State silvicultural BMPs (Best Management Practices).

The Forest assisted the Regional office in conducting a 3-day restoration workshop.

National Forests in Florida. The Forest Soil Scientist served on the State 208 silvicultural technical committee and assisted in developing silvicultural BMPs.

Francis Marion and Sumter National Forest in South Carolina. The Forest held a 2-day restoration workshop to train personnel in restoration work.

Emergency burned-area rehabilitation was completed on 685 acres of the Jumping Branch Wildfire. Filter fabric sediment traps were installed at 33 sites in the severely burned area. Forest Service Research is evaluating the effects on water quality from streams draining the burned area.

The Soil Conservation erosion inventory was completed on the National Forest.

The Watershed restoration needs inventory was updated for the Forest. Restoration work was completed on 120 acres of eroding forest land resulting in an annual sediment reduction of approximately 6,000 tons.

National Forests in Mississippi. Forest continued water quality sampling of streams for turbidity on 2 timber sales and 20 oil field sites. Restoration work was completed on 45 acres resulting in an estimated annual sediment reduction of 2,000 tons.

National Forests in North Carolina. The Forest Hydrologist served on the silvicultural technical advisory committee for 208 planning and assisted in developing silvicultural BMPs.

The Forest restored about 75 acres of damaged lands under Section 216 of the Flood Control Act of 1950 (Emergency Flood Prevention Program). This resulted in an estimated annual sediment reduction of 3,500 tons.

SOUTH ATLANTIC-GULF REGION

GEOLOGICAL SURVEY

Chowan-Roanoke Subregion

1. Suspended-sediment data are being collected daily during flood events and at 7-day intervals for periods of medium to low flows at Dan River at Paces, Va., and at Roanoke River at Randolph, Va., in cooperation with the U.S. Corps of Engineers.

Neuse-Pamlico Subregion

1. Suspended-sediment data are being collected on a daily basis at the main station on the Chicod Creek and on a monthly basis at three sites in the Chicod Creek watershed near Grimesland, N.C., in cooperation with the U.S. Soil Conservation Service.

Cape Fear Subregion

1. Suspended-sediment data are being collected at Black River at Dunn, N.C. to determine effects on stream characteristics by channel construction. This is being done in cooperation with the U.S. Corps of Engineers.

Pee Dee Subregion

1. Suspended-sediment data are being collected on a monthly basis at Scape Ore Swamp near Bishopville, S.C., as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a monthly basis at Lynches River at Effingham, S.C., at Black River at Kingstree, S.C., and at Pee Dee River at Pee Dee, S. C., as a part of NASQAN.

3. Suspended-sediment data are being collected at the Yadkin River at Yadkin College, N.C., as a Federal Sediment Index Station.

Edisto-Santee Subregion

1. Suspended-sediment data are being collected on a monthly basis at Lakes Marion - Moultrie Diversion Canal near Pineville, S.C., at Edisto River near Givhans, S.C., and at Coosawhatchie River near Hampton, S.C., as a part of NASQAN.

Ogeechee-Savannah Subregion

1. Suspended-sediment data are being collected on a monthly basis at Upper Three Runs near New Ellenton, S.C., as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a monthly basis at Savannah River near Clyo, Ga., and at Ogeechee River near Eden, Ga., as a part of NASQAN.

3. Suspended-sediment data are being collected on a periodic basis at Brier Creek near Wagesboro, Ga., in cooperation with the Georgia Geologic Survey.

Altamaha-St. Marys Subregion

1. Suspended-sediment data are being collected on a monthly basis at Falling Creek near Juliette, Ga., as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a monthly basis at Altamaha River near Everett City, Ga., at Satilla River at Atkinson, Ga., and at one site in Florida as a part of NASQAN.

3. Suspended-sediment data are being collected at South River near McDonough, Ga., at Yellow River near Covington, Ga., at Pates Creek near Flippin, Ga., Ohoope River near Reidsville, Ga., Perihaloway Creek near Jessup, Ga., and at Little Satilla River near Offerman, Ga., in cooperation with the Georgia Geologic Survey Division.

St. Johns Subregion

1. Suspended-sediment data are being collected on a periodic basis at three sites in Florida as a part of NASQAN.

Southern Florida Subregion

1. Suspended-sediment data are being collected on a periodic basis at seven sites in Florida as a part of NASQAN.

Peace-Tampa Bay Subregion

1. Suspended-sediment data are being collected on a periodic basis at five sites in Florida as a part of NASQAN.

Suwannee Subregion

1. Suspended-sediment data are being collected on a periodic basis at three sites in Florida as a part of NASQAN.

Ochlockonee Subregion

1. Suspended-sediment data are being collected on a periodic basis at one site in Florida as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at one site in Florida as a part of the National Hydrologic Benchmark Network.

Apalachicola Subregion

1. Suspended-sediment data are being collected on a periodic basis at three sites in Florida as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at Chattahoochee River near Cornelia, Ga., at Sweetwater Creek near Austell, Ga., at Upaton Creek near Columbus, Ga., in cooperation with the Georgia Geologic Survey.

Choctawhatchee-Escambia Subregion

1. Suspended-sediment data are being collected on a periodic basis at four sites in Florida as a part of NASQAN.

Alabama Subregion

1. Suspended-sediment data are being collected on a periodic basis at Coosawatee River near Ellijoy, Ga., Holly Creek near Chatsworth, Ga., and West Armuchee Creek near Subligna, Ga., in cooperation with the Georgia Geologic Survey.

2. Suspended-sediment data are being collected on a monthly basis at Alabama River at Montgomery, Ala., and at Alabama River at Clarboine, Ala., as a part of NASQAN.

Mobile-Tombigbee Subregion

1. Suspended-sediment data are being collected on a monthly basis at Tombigbee River at Gainesville, Ala., and at Tombigbee River at Coffeeville lock and dam, Ala., and at Black Warrior River below Warrior Dam near Eutaw, Ala., as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at Sipsey Fork near Grayson, Ala., as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected during flood-events at Mackeys Creek near Dennis, Miss., in cooperation with the U.S. Corps of Engineers, to estimate the impact of sediment loads on the Tennessee-Tombigbee Waterway.

Pascagoula Subregion

1. Suspended-sediment data are being collected on a monthly basis at two sites in Mississippi as a part of NASQAN.

2. Suspended-sediment data are being collected in a monthly and storm-event basis at Cypress Creek near Janice, Miss., as a part of the National Hydrologic Benchmark Network.

Pearl Subregion

1. Suspended-sediment data are being collected on a daily basis at Pearl River near Bogulusa, La., as a part of the Federal CBR program.

2. Suspended-sediment data are being collected on a monthly basis at Bogue Chitto River near Bush, La., as a part of NASQAN.

Special Studies

Suspended-sediment sampling by an automatic sampler was continued on Yellow Creek near Northport, Ala., and on Bear Creek near Samantha, Ala., as part of a study of coal-mine hydrology in cooperation with the Bureau of Land Management. Samples were collected monthly and during flood events at three additional sites in the Yellow Creek basin, one additional site in the Bear Creek basin, one site on Turkey Creek (Tuscaloosa County) near Tuscaloosa, Ala. Intermittent samples were collected on a tributary to Rocky Branch near its mouth in Tuscaloosa County.

Suspended-sediment sampling by an automatic sample was started on Trinity Creek near Carbon Hill, Ala., and on Blue Creek near Oakman, Ala., on Dec. 4, 1978.

Suspended-sediment sampling during storm events was continued in two agricultural basins in southwest Georgia in conjunction with an ongoing study of the effects of agricultural runoff on receiving waters.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
P.O. Box V
Oil and Gas Board Building
Room 202
University, AL 35486

District Chief, WRD
U.S. Geological Survey
325 John Knox Road, Suite F-240
Tallahassee, FL 32303

District Chief, WRD
U.S. Geological Survey
6481 Peachtree Industrial
Boulevard, Suite B
Doraville, GA 30360

District Chief, WRD
U.S. Geological Survey
P.O. Box 66492
6554 Florida Boulevard
Baton Rouge, LA 70896

District Chief, WRD
U.S. Geological Survey
100 W. Capitol St., Suite 710
Jackson, MS 39201

District Chief, WRD
U.S. Geological Survey
P.O. Box 2857,
Century Station Post Office Building
Room 436
Raleigh, NC 27602

District Chief, WRD
U.S. Geological Survey
2001 Assembly Street, Suite 200
Columbia, SC 29201

District Chief, WRD
U.S. Geological Survey
200 West Grace Street, Room 304
Richmond, VA 23220

SOUTH ATLANTIC-GULF REGION

SOIL CONSERVATION SERVICE

1. Studies of sediment damages and determinations of sediment yields were made for work plans in the following watersheds during 1978:

   a. Public Law 566

Major Drainage	Watershed	Stream	County	State
Choctawhatchee-Escambia	Patsaliga	Buck Creek	Covington	Alabama
Chattahoochee R.	Potatoe Creek	Wasp Creek	Pike	Georgia
Chattahoochee R.	Bull Creek	Trooper Creek	Muscogee	Georgia
Coosa R.	Cartecay R.	Tickanetley Cr.	Gilmer	Georgia
Savannah R.	North Fork Broad River	Denman's Cr.	Stephens	Georgia
Rocky River	Coddle-Coldwater Dutch Buffalo	Coddle-Coldwater Dutch Buffalo	Cabarrus	N.C.
Yadkin River	Tri-Creek	Grants, Town and Crane Creeks	Rowan	N.C.
Northeast Cape Fear River	Limestone-Muddy Creek	Limestone-Muddy Creek	Duplin	N.C.
Saluda River	Little River	Little River	Laurens	S.C.

   b. River Basin Investigations

Major Basins	Basin Reported	State
Tar-Neuse	Tar-Neuse	N.C.

2. Sedimentation Surveys

   a. Special Studies - Sedimentation surveys made in Georgia.

Reservoir	Date of Survey	Location County	Drainage Area (sq. mi.)
Bull Creek #4	8/30/77	Muscogee	1.35
North Fork of Broad River #2	9/28/78	Stephens	.94
Cartecay River #7	6/15/78	Gilmer	3.72
Potato Creek #56	10/17/77	Pike	6.48

A sediment deposition survey was completed on Wateree Creek Watershed, Structure No. 1, Fairfield County, South Carolina, during the evaluation period.

GREAT LAKES REGION

GEOLOGICAL SURVEY

Western Lake Superior Subregion

1. Suspended-sediment data are being collected on a daily and storm-event basis at Nemadji River near Superior, Wis., at Little Balsam Creek near Patzau, Wis., Pine Creek near Moquah, Wis., at Little Balsam Creek near Foxboro, Wis., at Tributary to Little Balsam Creek near Patzau, WI. at Pine Creek at Moquah, Wis., and at Tributary to Pine Creek at Moquah, WI.

2. Suspended-sediment data are being collected on a periodic and storm-event basis at Nemadji River Nr. South Superior, Wisc., at Bad River near Odanah, Wis., at Baptism River near Beaver Bay, Minn., and at St. Louis River at Scanlon, Minn., as a part of NASQAN.

3. Suspended-sediment data are being collected on a daily basis by an automatic sampler at Elim Creek near Holyoke, Minn., at Skunk Creek below Elim Creek near Holyoke, Minn., and at Deer Creek near Holyoke, Minn., for the Red Clay Project for the Soil and Water Conservation District in Douglas County, Wisconsin.

Southern Lake Superior-Lake Superior Subregion

1. Suspended-sediment data are being collected on a intermittent basis at Washington Creek at Windigo (Isle Royale), Mich., as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a monthly basis at Ontonagon River near Rockland, Mich., and at Tahquamenon River near Tahquamenon, Mich., as a part of NASQAN.

Northwestern Lake Michigan Subregion

1. Suspended-sediment data are being collected on a weekly and storm-event basis at Popple River near Fence, Wis., as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a periodic and storm-event basis at Fox River at Wrightstown, Wis., at Ford River near Hyde, Mich., at Escanaba River at Cornell, Mich., and at Menominee River near McAllister, Wis., as a part of NASQAN.

Southwestern Lake Michigan Subregion

1. Suspended-sediment data are being collected on a periodic and storm-event basis at Milwaukee River at Milwaukee, Wis., and at Little Calumet River near McCool, Ind., as a part of NASQAN.

2. Suspended-sediment data are being collected at Trail Creek at Michigan City, Ind., and Galena River near LaPorte, Ind., for the State of Indiana.

Southeastern Lake Michigan Subregion

1. Suspended-sediment data are being collected on a weekly basis at Pigeon Creek near Angola, Ind., for the State of Indiana.

2. Suspended-sediment data are being collected on an intermittent basis at North Branch Elkhart River at Cosperville, Ind., for the State of Indiana.

3. Suspended-sediment data are being collectd on a high-flow only basis at Elkhart River at Goshen, Ind., for the State of Indiana.

4. Suspended-sediment data are being collected on a monthly basis at Kalamazoo River at Saugatuck, Mich., as a part of NASQAN.

Northeastern Lake Michigan-Lake Michigan Subregion

1. Suspended-sediment data are being collected on a monthly basis at Manistique River above Manistique, Mich., at Muskegon River near Bridgeton, Mich., and at Manistee River at Manistee, Mich., as a part of NASQAN.

Northwestern Lake Huron Subregion

1. Suspended-sediment data are being collected on a monthly basis at Cheboygan River at Cheboygan, Mich., as a part of NASQAN.

Southwestern Lake Huron-Lake Huron Subregion

1. Suspended-sediment data are being collectd on a monthly basis at Rifle River near Sterling, Mich., and at Saginaw River at Saginaw, Mich., as a part of NASQAN.

St. Clair-Detroit River Subregion

1. Suspended-sediment data are being collected on a monthly basis at Clinton River at Mt. Clemons, Mich., and at Detroit River at Detroit, Mich., as a part of NASQAN.

Western Lake Erie Subregion

1. Suspended-sediment data are being collected on a daily basis at Maumee River at Waterville, Ohio, in cooperation with the U.S. Corps of Engineers, and at Sandusky River near Freemont, Ohio, in cooperation with the Ohio Department of National Resources.

Southern Lake Erie Subregion

1. Suspended-sedimient data are being collected on a daily basis at Rock River near Berea, Ohio, at Chagrin River at Willoughby, Ohio, and at Cuyahoga River at Old Portage, Ohio, and at Tinkers Creek at Bedford, Ohio, for the Three Rivers Watershed District, Cleveland, Ohio.

2. Suspended-sediment data are being collected on a daily basis at Cuyahoga River at Independence, Ohio, at Big Creek at Cleveland, Ohio, and Euclid Creek near Euclid, Ohio, in cooperation with the U.S. Corps of Engineers, Buffalo District.

3. Suspended-sediment data are being collected on a daily basis at Grand River at Painseville, Ohio, in cooperation with the Ohio Department of Natural Resources.

Eastern Lake Erie-Lake Erie Subregion

1. Suspended-sediment data are being collected on a periodic basis at Cattaraugas Creek at Gowanda, N.Y. and Tonawanda Creek at Batavia, N.Y. as a part of NASQAN.

Southwestern Lake Ontario Subregion

1. Suspended-sediment data are being collected on a periodic basis at Niagara River (Lake Ontario) at Fort Niagara, N.Y., and at Genesee River at Charlotte Docks at Rochester, N.Y., as a part of NASQAN.

Southeastern Lake Ontario Subregion

1. Suspended-sediment data are being collected on a periodic basis at Oswego River at Lock 7 at Oswego, N.Y., and at Sandy Creek at Adams, N.Y., as a part of NASQAN.

Northeastern Lake Ontario-Lake Ontario-St. Lawrence Subregion

1. Suspended-sediment data are being collected on a periodic basis at Black River at Watertown, N.Y., at St. Regis River at Brasher Center, N.Y., at St. Lawrence River at Cornwall, Ontario, near Massena, N.Y., and at Oswegatchie River at Hauvelton, N.Y., as a part of NASQAN.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
1819 North Meridian Street
Indianapolis, IN 46202

District Chief, WRD
U.S. Geological Survey
6520 Mercantile Way, Suite 5
Lansing, MI 48910

District Chief, WRD
U.S. Geological Survey
Post Office Building, Room 702
St. Paul, MN 55101

District Chief, WRD
U.S. Geological Survey
975 West Third Avenue
Columbus, OH 43212

District Chief, WRD
U.S. Geological Survey
P.O. Box 1350
U.S. Post Office and
Courthouse Building, Room 343
Albany, NY 12201

District Chief, WRD
U.S. Geological Survey
1815 University Avenue, Room 200
Madison, WI 53706

SOIL CONSERVATION SERVICE

1. Continuing or initial studies of sediment transport and determinations of sediment yield were made in the following watersheds:

   a. Public Law 566

Major Drainage	Watershed	Stream	County(s)	State
Lake Michigan	East Upper Maple River	Maple River	Shiawassee Gratiot	Michigan
Lake Huron	Au Gres River	Au Gres River	Arenac Iosco Ogemaw	Michigan

   b. Resource Conservation and Development

Project Name	Measure Name	County	State
Sauk Trails	South Branch Paw Paw River	Van Buren	Michigan
Sauk Trails	Paw Paw River	Van Buren	Michigan

2. Reservoir Sedimentation Surveys

   a. A reservoir sedimentation survey was made on the Seymour Chez pond in St. Louis County, Minnesota. The average annual rate of sediment accumulation for a 5-year period has been 0.28 acre feet per square mile.

OHIO REGION

CORPS OF ENGINEERS

Ohio River Division

Report on sedimentation activities in the Ohio River Division for calendar year 1978 is as follows:

Sedimentation Resurveys.

1. J. Percy Priest Reservoir. Resurvey of J. Percy Priest Reservoir has been completed and subsequent analysis will be presented in a Design Memorandum to be submitted to ORD in FY 79.

2. Fishtrap Lake, Levisa Fork, Kentucky. Supplemental sediment range survey data, to that obtained during the 1977 field survey at Fishtrap Lake, were required to determine the volume and distribution of sediment in the lake. The additional data were obtained in 1978 and a report on the resurvey is scheduled for completion by the Huntington District in 1979.

3. Dewey Lake, Johns Creek, Kentucky. Supplemental sediment range survey data, to that obtained during the 1977 resurvey of sediment ranges at Dewey Lake, were required to determine the sedimentation rate in the lake. The additional information was obtained in 1978 and a report on the resurvey is scheduled for completion by the Huntington District in 1979.

Initial Range Surveys and Range Layouts.

1. Martins Fork Reservoir. The initial reservoir sedimentation range survey has been completed.

2. Laurel River Reservoir. Monumentation and part of the initial survey were completed in FY 78. The complete survey and documentation will be in Design Memorandum No. 9, Reservoir Sedimentation Ranges, Laurel River Reservoir, Supplement. This report will present the base field cross sections that were shown in layout form in the January 1966 Design Memorandum of the same title. The report will be completed in FY 79.

3. Design Memoranda for sediment range networks at R.D. Bailey Lake, Guyandot River, West Virginia; Alum Creek Lake, Alum Creek, Ohio; and at Beech Fork Lake, Beech Fork, West Virginia, were approved by the Ohio River Division in 1978 after revision of the reports by the Huntington District in response to Division comments.

4. Beech Fork Lake, Twelvepole Creek, West Virginia. The four Category "A" sediment ranges above Beech Fork Dam, namely 1-A, 2-A, 20-A and 21-A, recommended in Design Memorandum No. 12 and approved by the Ohio River Division by Third Indorsement, 10 March 1978, were established and profiled in 1978.

5. The four Category "C" sediment ranges below Fishtrap Dam, recommended in Design Memorandum No. 22 and approved by the Ohio River Division by First Indorsement, 7 February 1977, were established and profiles along the ranges obtained in 1978.

6. Layout and initial survey of sedimentation ranges at Patoka Lake began in FY 78.

Sediment Load Measurements.

1. Fishtrap Lake, Levisa Fork, Kentucky and Dewey Lake, Johns Creek, Kentucky. Suspended sediment data were collected by the U.S. Geological Survey in cooperation with the Huntington District at Levisa Fork at Big Rock, Virginia and Johns Creek at Meta, Kentucky, gaging stations. The Huntington District collected suspended sediment data on four tributary streams in the Fishtrap Lake drainage basin and on three tributary streams in the Dewey Lake drainage basin during 1978.

2. R.D. Bailey Lake, Guyandot River, West Virginia. The sediment monitoring program, being conducted in cooperation with the U.S. Geological Survey at R.D. Bailey Lake, was modified in 1978. Sediment data were collected by the U.S. Geological Survey at the Guyandot River near Baileysville, West Virginia, monitoring station during 1978 and on nearby tributary streams, Clear Fork and Indian Creek through 30 September 1978. After that date, the Huntington District operated the Clear Fork and Indian Creek monitoring stations.

3. Data collection continued on the pilot study of the sediment control structure on Defeated Creek, a tributary of Carr Fork Lake.

4. Martins Fork Reservoir. The results of a sediment monitoring program and subsequent analysis are documented in Design Memorandum No. 9, Reservoir Sedimentation Ranges, Martins Fork Reservoir dated January 1979.

5. Big South Fork Recreation Area. A water quality monitoring station has been placed in the New River at New River, Tennessee. This station measures sediment concentration twice a day and during storm events. Two additional water quality monitoring stations are scheduled for the near future. These stations are located at Big South Fork near Stearns and Clear Fork near Robins.

6. Collection of suspended sediment data by the U.S. Geological Survey, in cooperation with the Huntington District, continued during 1978 at the Tug Fork at Glenhayes, West Virginia, and the Levisa Fork at Paintsville, Kentucky, gaging stations. These data are being used in the development of a mathematical model of the lower reach of the Big Sandy River by the Waterways Experiment Station at Vicksburg, Mississippi. The Big Sandy River discharges into the Ohio River between Huntington, West Virginia, and Ashland, Kentucky, and into the pool created by the Greenup Dam. The objective of the study is to identify measures to maintain sediment movement through the lower reach of the Big Sandy River into the Ohio River. Dredging to maintain a navigation channel in this area would thus be reduced.

Additional Division Activities.

Special Programs.

(a) Big Sandy and Upper Cumberland River Basins. A cost estimate has been made to study runoff impacts due to land use. The main thrust of this study was to determine surface mining effects on streamflow characteristics. The cost estimate, done jointly by Huntington and Nashville Districts, is presented in a scope of work entitled, "Study of Runoff Impacts Due to Land Use in the Big Sandy and Upper Cumberland River Basins."

(b) Tennessee-Tombigbee Waterway. Plans and specifications for Sections 4 and 2A require erosion/sediment control measures for disposal and work areas to effectively reduce migration of sediment to the waterway. The disposal areas have been redesigned to emulate natural land formations to prevent long severe slopes with high erosion potential. Several construction practices have been modified or eliminated to reduce the susceptibility of disturbed land to erosion. A sediment curtain is planned for installation at the northern end of the project. A large sediment pond at the southern end of the project is also planned. As part of the specifications, the contractor is required to maintain certain turbidity standards for discharges up to the 85 percent duration discharge and sediment concentration standards for higher discharges. Two water quality monitoring stations are in operation; one on Yellow Creek near the Highway 25 bridge and the other on Mackeys Creek near Highway 4 bridge. Both are standard USGS continuous monitors and measure turbidity and sediment concentration as well as other water quality parameters.

OHIO REGION

FOREST SERVICE

Daniel Boone National Forest in Kentucky. The Forest sampled nine streams for turbidity as part of their water quality monitoring program.

The Forest Soil Scientist is a member of the 208 silvicultural Technical Committee and assisted in developing State BMPs.

Burned area emergency erosion control was completed on about 200 acres of the Stallion Fork Wildfire.

OHIO REGION

GEOLOGICAL SURVEY

Monongahela Subregion

1. Suspended-sediment data are being collected about monthly at Shavers Fork at Bemis, W. Va., and at Shavers Fork near Elkins, W. Va., in cooperation with the West Virginia Department of Highways.

2. Suspended-sediment data are being collected on a daily basis at Taylor Run at Bowden, W. Va., at Shavers Fork above Bowden, W. Va. and at Shavers Fork below Bowden, W. Va., as part of the Shavers Fork Basin Cooperative Program with the West Virginia Department of Highways.

3. Suspended-sediment data are being collected at Monongahola River at Braddock, Ohio, Allegheny River at New Kensington, Ohio, at Red Bank Creek at St. Charles, Ohio, at Stony Creek at Slippery Rock Creek at Wurtemburg, Ohio, as a part of the U.S.G.S.'s Coal Hydrology Program.

Upper Ohio Subregion

1. Suspended-sediment data are being collected on a monthly basis at Ohio River at Benwood, near Wheeling, W. Va., and at Little Kanawha River at Palistine, W. Va., as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at Kings Creek near Weirton, W. Va., at Little Grave Creek near Moundsville, W. Va., at Par Run near mouth near Moundsville, W. Va., and at Middle Grave Creek near Moundsville, W. Va., in cooperation with the U.S. Soil Conservation Services.

3. Suspended-sediment data are being collected on a daily basis at Hocking River below Athens, Ohio, in cooperation with the Ohio Department of National of Natural Resources.

4. Suspended-sediment data are being collected on a daily basis at Consol Run near Bloomingdale, Ohio, in cooperation with the U.S. Environmental Protection Agency (EPA).

Muskingum Subregion

1. Suspended-sediment data are being collected on a daily basis at Muskingum River at McConnelsville, Ohio, in cooperation with the Ohio Department of National Resources.

2. Suspended-sediment data are being collected on a daily basis at Clear Fork tributary near Hanover, Ohio, at Sand Fork near Wakatomika, Ohio, and at Opossum Run tributary near Wakatomika, Ohio, in cooperation with the U.S. EPA.

Kanawha Subregion

1. Suspended-sediment data are being collected on a near monthly basis at Kanawha River at Winfield, W. Va. as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Little Coal River at Danville, W. Va., at Little Coal River at Julian, W. Va., at Big Coal River near Alum Creek, W. Va., at Coal River at Alum Creek, W. Va., and at Coal River at Tornado, W. Va., in cooperation with the West Virginia Department of Highways.

3. Suspended-sediment data are being collected on a near monthly basis at Howard Creek at Caldwell, W. Va., in cooperation with the U.S. Soil Conservation Service.

4. Suspended-sediment data were collected about monthly at Cranbery Creek at Beckley, W. Va., at Little Whitestick Creek at Beckley, WV, at Soak Creek at Sophia, W. Va., at Crab Orchard Creek at Crab Orchard, W. Va., at Beaver Creek at Beaver, W. Va., and at Piney Creek at Raleigh, W. Va.

Scioto Subregion

1. Suspended-sediment data are being collected on a daily basis at Sciota River at Higby, Ohio, in cooperation with the Ohio Department of National Resources.

2. Suspended-sediment data are being collected on a daily basis at the following locations in cooperation with the Ohio Department of Transportation:

Olentangy River near Worthington, Ohio
Dublin-Granville Road Creek at Worthington, Ohio
State Highway 325 Creek at Worthington, Ohio
Rush Run at Worthington, Ohio
Linwood Road Creek at Columbus, Ohio
Olentangy River Road Creek at Columbus, Ohio
Olentangy River Road Creek at St. Highway 325, at Columbus, Ohio
Olentangy River at Henderson Road, at Columbus, Ohio

Big Sandy-Guyandotte Subregion

1. Suspended-sediment data are being collected on a daily basis at Levisa Fork at Big Rock, Va., in cooperation with the U.S. Corps of Engineers, Huntington District.

2. Suspended-sediment data are being collected, on a near monthly basis at Guyandotte River at Branchland, W. Va., as a part of NASQAN.

3. Suspended-sediment data are being collected on a daily basis at Guyandotte River near Baileysville, W. Va., at Clear Fork at Clear Fork, W. Va., and at Indian Creek at Fanrock, W. Va., as part of the Cooperation Reservoir Study with the U.S. Corps of Engineers.

4. Suspended-sediment data are being collected on a daily basis at Marsh Fork at Maben, W. Va., at Still Run at Itman, W. Va., at Allen Creek at Allen Junction, W. Va., and at Bearhole Fork at Pineville, W. Va., as part of a study on the effects of mining on the hydrologic environment of Southern West Virginia, in cooperation with the West Virginia Geological and Economic Survey.

5. Suspended-sediment data are being collected on about monthly and storm event basis at Milan Fork at McGraws, W. Va., as part of a study of the effects of mining on the hydrologic environment of Southern West Virginia, in cooperation with the West Virginia Geological and Economic Survey.

6. Suspended-sediment data are being collected on a daily basis at Elkhorn Creek at Maitland, W. Va., at Tug Fork at Welch, W. Va., and at Pigeon Creek at Lenore, W. Va., (starting October, 1978) as part of the Tug River Basin project in cooperation with the West Virginia Geological and Economic Survey and the West Virginia Department of Natural Resources.

7. Suspended-sediment data are being collected on a daily basis at Tug Fork near Glenhayes, W. Va., in cooperation with the U.S. Corps of Engineers and the West Virginia Geological and Economic Survey (starting October, 1978) as part of the Tug River Basin Project.

8. Suspended-sediment data are being collected on a daily basis, at Levisa Fork at Paintsville, Ky., in cooperation with the U.S. Corps of Engineers, Huntington District, to measure sediment discharge entering the downstream reaches of the Big Sandy River and as a baseline station for coal-hydrology studies.

9. Suspended-sediment data are being collected on a monthly basis at Big Sandy River at Louisa, Ky., and at Ohio River at Greenup Dam, Ky., as a part of NASQAN.

10. Suspended-sediment data are being collected on a daily basis at Johns Creek near Meta, Ky., to monitor sediment discharge into lakes. The work is being done in cooperation with the U.S. Corps of Engineers, Huntington District.

11. Suspended-sediment data are being collected on a daily basis at Grapevine Creek near Phyllis, Ky., and at Dicks Fork at Phyllis, Ky., as a part of a Federally funded project to determine effects of coal mining in the Grapevine Creek basin. Sediment data are also sampled on a quarterly, basin at five other sites in the basin.

Great Miami Subregion

1. Suspended-sediment data are being collected on a weekly basis at Whitewater River near Hagarstown, Ind., on an intermittent basis at East Fork Whitewater River at Abington, Ind., and on a flood-event basis at Whitewater River near Alpine, Ind. This work was done for the State of Indiana.

2. Suspended-sediment data are being collected on an intermittent basis at Whitewater River at Brookville, Ind., as a part of NASQAN.

Middle Ohio Subregion

1. Suspended-sediment data are being collected on a monthly basis at Uppertwin Creek at McGraw, Ohio, and at South Hogan Creek near Dillsbone, Ind., as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected at Little Miami River at Milford, Ohio, in cooperation with the Ohio Department of Natural Resources.

3. Suspended-sediment data are being collected at the following stations in the Racoon River basin on a daily basis in cooperation with the Ohio Department of Natural Resources:

Sandy Run above Big Four Hollow Creek, near Lake Hope, Ohio
Big Four Hollow Creek below East Fork, near Lake Hope, Ohio
Big Four Hollow Creek near Lake Hope, Ohio
Hull Hollow Creek near Lake Hope, Ohio
Sandy Run below Hull Hollow Creek, near Lake Hope, Ohio

Licking-Kentucky Subregion

1. Suspended-sediment data are being collected on a monthly basis at Ohio River at Markland Dam, Ky., at Licking River at Butler, Ky., and at Kentucky River at Lock 2 at Lockport, Ky., as a part of NASQAN.

2. Suspended-sediment data are being collected on a five week frequency at the following stations to define sediment yields by physiographic province in Kentucky.

North Fork Triplett Creek near Morehead, Ky.
North Fork Licking River near Lewisburg, Ky.
Troublesome Creek at Noble, Ky.
Goose Creek at Manchester, Ky.
Red River near Hazel Green, Ky.
Elkhorn Creek near Frankfort, Ky.

This work is done in cooperation with the Kentucky Geological Survey.

3. Suspended-sediment data are being collected on a daily basis at Middle Fork Kentucky River near Hyden, Ky., in cooperation with the U.S. Corps of Engineers, Louisville District.

Wabash Subregion

1. Suspended-sediment data are being collected on a daily basis at East Fork White River at Seymour, Ind., for the State of Indiana, and at Big Blue River at Carthage, Ind., for the U.S. Corps of Engineers. Additional sampling for the State of Indiana consists of three weekly stations, five intermittent stations, and four high-flow only stations.

2. Suspended-sediment data are being collected on a daily basis at Eel River near Logansport, Ind., at Wabash River at Lafayette, Ind., and at Big Racoon Creek near Fincastle, Ind., for the State of Indiana.

3. Suspended-sediment data are being collected on an intermittent basis at seven stations in Indiana and on a storm-event basis at three stations in Indiana.

4. Suspended-sediment data are being collected on a intermittent basis at Wabash River at New Harmony, Ind., and on a monthly basis at Little Wabash River at Carmi., Ill., as a part of NASQAN.

5. Suspended-sediment data are being collected on a daily basis at Little Wabash River at Louisville, Ill., and at Embarras River near Oakland, Ill., in cooperation with the U.S. Corps of Engineers, Louisville District.

Cumberland Subregion

1. Suspended-sediment data are being collected on a monthly basis at Cumberland River at Carthage, Tenn., and at Cumberland River near Grand Rivers, Ky., as a part of NASQAN.

2. Suspended-sediment data are being collected on a 5-week frequency at the following stations in cooperation with the Kentucky Geological Survey:

Yellow Creek near Middlesboro, Ky.
Buck Creek near Shopville, Ky.
Little River near Cadiz, Ky.

Lower Ohio Subregions

1. Suspended-sediment data are being collected on a monthly basis at Ohio River at Cannelton Dam, Ky., at Green River near Beech Grove, Ky., and at Ohio River at Lock and Dam 53 near Grand Chain, Ill., as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Green River at Munfordville, Ky., as a part of the Federal Sediment Index Network. 3. Suspended-sediment data are being collected on a 5-week frequency at the following stations in cooperation with the Kentucky Geological Survey.

Russell Creek near Columbia, Ky.
Nolair River near White Mills, Ky.
South Fork Panther Creek near Whitesville, Ky.
Massac Creek near Paducah, Ky.
Bacon Creek near Priceville, Ky. (started Oct. 1, 1978)
Poud River near Apex, Ky. (discontinued Sept. 30, 1978)

3. Suspended-sediment data are being collected on a monthly basis at Rolling Fork near Lebanon Junction, Ky., and at Salt River at Shepherdsville, Ky., as a part of NASQAN.

4. Suspended-sediment data are being collected on an intermittent basis at Indian-Kentuck Creek near Canaan, Ind. and on a highflow only basis at Middle Fork Anderson River at Bristow, Ind., for the State of Indiana.

5. Suspended-sediment data were determined at Ohio River at Louisville, Ky., during the December, 1978 flood. this work was supported by State and Federal agencies.

Special Studies

A four-year study began in 1978 to evaluate surface mining influences on sedimentation characteristcs of basins in the Allegheny and Monogahela geologic series in Ohio.

A four-year study began in 1978 to evaluate and quantify any impact that highway construction has on sediment loads to neighoring streams at the construction site of Ohio State Route 315 in Columbus, Ohio.

Sediment dischage measurements were made on a quarterly basis at 17 locations in the Big Sandy basin in connection with the Federally-funded project, "Downstream effects of coal mining on Levisa Fork of the Big Sandy River." Operation of these sediment stations was discontinued on June 30, 1978, when the project was finished. The project report is in progress.

Suspended-sediment data were collected with automatic samplers at 2 sites in the Big Sandy Creek basin during 1978. The sites are a tributary to Stoney Fork near Gibson Glade and Stoney Fork near Elliotsville. The data are being collected as part of a study to evaluate the effects of surface mining on the Big Sandy Creek basin of Southwestern Pennsylvania.

In cooperation with the Tennessee Department of Transportation, the problem of scour at highway bridges is being investigated at known and potential problem sites across Tennessee. Reports documenting data and research findings are planned.

In cooperation with several State and Federal agencies, suspended and bed sediment yields are being measured at several locations in the heavily mined New River basin. Suspended sediment discharge is measured at two storm and three daily-plus-storm stations. Bedload measurements are also made at two stations. Periodic bed and suspended sediment particle size determinations are made.

In cooperation with the U.S. Army Corps of Engineers two suspended sediment discharge stations are being established; one at the mouth of the Clear Fork basin and one on the Big South Fork Cumberland River. These stations will monitor daily and storm loads. This data, plus data from the New River basin, will be used to define current water quality conditions within the Big South Fork National River and Recreation Area.

The report, "Fluvial sediment study of Fishtrap and Dewey Lakes drainage basins," by W.F. Curtis, R.F. Flint, and Frederick H. George was published by U.S.G.S. in March 1978 as WRI 77-123.

Professional paper 427D by John A. McCabe, a report on the 1974 phase of sediment studies at Cane Branch near Parkers Lake, Ky., is in colleague review stage. This work was done in cooperation with a number of Federal and state agencies.

For additional information about Gelogical Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
P.O. Box 1026
605 North Neil Street
Champaign, IL 61820

District Chief, WRD
U.S. Geological Survey
1819 North Meridian Street
Indianapolis, IN 46202

District Chief, WRD
U.S. Geological Survey
975 West Third Avenue
Columbus, OH 43212

District Chief, WRD
U.S. Geological Survey
P.O. Box 1107
Federal Building, Fourth Floor
228 Walnut Street
Harrisburg, PA 17108

District Chief, WRD
U.S. Geological Survey
Federal Building and
U.S. Courthouse, Room A-413
Nashville, TN 37203

District Chief, WRD
U.S. Geological Survey
200 West Grace Street
Room 304
Richmond, VA 23220

District Chief, WRD
U.S. Geological Survey
Federal Building and U.S. Courthouse
Room 3017
500 Quarrier Street
East Charleston, WV 25301

OHIO REGION

SOIL CONSERVATION SERVICE

1. Studies of sediment damages and determinations of sediment yields were made for work plans in the following watersheds:

   a. Public Law 566

Major Drainage	Watershed	Stream	County(s)	State
Wabash River	North Fork of Embarass	North Fork of Embarass	Edgar Coles Cumberland Clark Jasper Crawford	Illinois
Ohio River	Middle Fork of Anderson River	Middle Fork of Anderson River	Perry Crawford	Indiana

   b. Resource Conservation and Development

Project Name	Measure Name	County(s)	State
Shawnee Hills	Sandy Branch	Massac	Illinois
Shawnee Hills	Spence Hollow	Massac	Illinois

2. Reservoir Sedimentation Surveys

   a. A reservoir sedimentation survey was made on Decker Lake in Miami County, Ohio. The average annual rate of sediment accumulation for a 28-year period has been 0.60 acre feet per square mile.

   b. Reservoir Sedimentation Surveys were made to determine remaining water storage for the following muncipial water supply lakes:

Major Drainage	Watershed	Stream	Lake	County	State
Ohio River	Upper Tradewater	Dripping Spring	Croften	Christian	Kentucky
Ohio River	Valley Creek	Freeman Creek	MPS #4	Hardin	Kentucky
Ohio River	N.F. Nolin River	Salem Creek	MPS #3	Larue	Kentucky

TENNESSEE REGION

FOREST SERVICE

Chattachoochee-Oconee National Forests in Georgia. The Forest is sampling water quality from streams at 10 stations to determine background water quality and impacts on water quality from timber management activities. Two ISCO automatic samplers are in use.

The Restoration Needs Inventory was updated--77 acres of critically eroding forest lands were rehabilitated resulting in an annual decrease in sediment of about 4,000 tons.

National Forests in North Carolina. Water quality sampling continued on eight established background monitoring stations on the Davidson River Barometer Watershed.

Jefferson National Forest. The Forest completed the SCS erosion inventory plots.

The Forest Watershed Scientist was assigned to the 208 silvicultural technical advisory committee and assisted in developing State silvicultural BMPs.

Emergency watershed damage (Section 216) was repaired on 19 acres from the storm of April 1977. This resulted in an estimated annual sediment reduction of 1,000 tons.

Cherokee National Forest in Tennessee. The Forest Watershed Scientist is a member of the 216 silvicultural technical committee and assisted in preparing State silvicultural BMPs.

About 30 acres of severely burned forest land received emergency burned area erosion control treatment. The Forest estimates a reduction to over 6,000 tons of sediment annually from the above and other management activities.

TENNESSEE REGION

GEOLOGICAL SURVEY

Upper Tennessee Subregion

1. Suspended-sediment data are being collected on a monthly basis at French Broad River near Knoxville, Tenn., and at Clinch River at Melton Hill Dam, Tenn., as part of NASQAN.

Middle Tennessee-Hiwassee Subregion

1. Suspended-sediment data are being collected on a monthly basis at Tennessee River at Watts Bar Dam, Tenn., as part of NASQAN.

Middle Tennessee-Elk Subregion

1. Suspended-sediment data are being collected on a monthly basis at Tennessee River at South Pittsburg, Tenn., as a part of NASQAN. This site is also in a national pesticide monitoring network which requires periodic streambed sediment sampling.

Lower Tennessee Subregion

1. Suspended-sediment data are being collected on a monthly basis at Tennessee River at Pickwick Landing Dam, Tenn., and at Tennessee River at Highway 60 near Paducah, Ky., as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at Buffalo River near Flat Woods, Tenn., as part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a 5 week-frequency at West Fork Clarks River near Brewers Creek, Ky., and Massac Creek near Paducah, Ky., in cooperation with the Kentucky Geological Survey.

4. Suspended-sediment data are being collected on a periodic basis at Toccoa River near Dial, Ga., in cooperation with the Georgia Geologic Survey.

5. Suspended-sediment data are being collected on a daily basis at Yellow Creek near Doskie, Miss. and at Yellow Creek at Cross Roads, Miss., in cooperation with the U.S. Corps of Engineers.

Special Studies

In cooperation with the Tennessee Department of Transportation, the problem of scour at highway bridges is being investigated at known and potential problem sites across Tennessee. Reports documenting data and research findings are planned.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
6481 Peachtree Industrial
Boulevard, Suite B
Doraville, GA 30360

District Chief, WRD
U.S. Geological Survey
100 W. Capitol St., Suite 710
Jackson, MS 39201

District Chief, WRD
U.S. Geological Survey
P.O. Box 2857, Century Station
Post Office Building, Room 436
Raleigh, NC 27602

District Chief, WRD
U.S. Geological Survey
Federal Building and U.S. Courthouse
Room A-413
Nashville, TN 37203

TENNESSEE VALLEY AUTHORITY

Reservoir Sediment Investigations

1. LaFollette Water Supply Reservoir (Upper Ollis Creek Reservoir). This reservoir, which was filled in 1964, was surveyed for the eighth consecutive year since the 46 sediment ranges were established, sounded, and probed in 1970. Deposited sediment accumulations are being monitored to ascertain the effects of strip mining and subsequent reclamation work in the watershed. The 1978 survey showed a total of 52 acre-feet of sediment, a loss of 1 acre-foot, believed due to settlement of the sediment, since 1977.

2. Upper Bear Creek Reservoir. Fifty-six sediment ranges were established and sounded in October 1978. After final closure of the dam on January 6, 1978, the reservoir reached normal pool level in May 1978.

3. Nolichucky Reservoir. Twenty-seven sediment ranges were sounded in May 1978. The reservoir was completed in 1913; the first sediment survey was made in 1938 when original volume and sediment deposits to that time were determined by probings. Other surveys were made in 1947, 1953, 1958, 1961, 1967, and 1970. Calculations resulting from the 1978 survey show a total of 16,100 acre-feet of sediment for a storage loss of 88.6 percent.

Sediment Load Measurements

1. Pine Tree Branch Watershed. Total sediment yield continued to be measured at this research watershed in west Tennessee until mid-year when all hydrologic measurements were discontinued. A report summarizing project results will be issued.

Special Investigations

1. Redstone Arsenal-Huntsville, Alabama. In connection with a multi-agency investigation of DDT contamination soundings and probings were made in the Wheeler Reservoir embayment on Indian Creek and Huntsville Spring Branch to determine sediment deposition in the embayment. Sediment core samples were taken to define DDT concentrations in the sediment at various locations. The study is continuing under the leadership of the Corps of Engineers.

For additional information contact: Claude H. Smith, Chief
Data Services Branch
Tennessee Valley Authority
350 Evans Building
Knoxville, Tennessee 37902

UPPER MISSISSIPPI REGION

CORPS OF ENGINEERS

North Central Division

In the field of Coastal Engineering - Sandbypassing - Continuing concern regarding shore damage due to Federal navigation projects has resulted in an operational requirement for periodic sandbypassing at authorized Section 111 projects. Section 111 studies have been made for over 26 harbors which has resulted in 10 authorized projects to date with a potential for 12 more. In total, NCD anticipates a total operational requirement for bypassing of about 500,000 cubic yards of sand annually at these harbors. Periodic maintenance of mitigation projects is intended to provide the quantity of littoral material which is interrupted and/or diverted by navigation projects. As a result, maintenance of Section 111 projects takes the form of bypassing where environmentally, engineeringly and operationally feasible. NCD requested WES to design, procure and assemble a truck mounted jet pump (educator) system on a reimbursable basis for sandbypassing at Section 111 projects. The system has three main subsystems: (1) a pump trailer, (2) a jet pump module, and (3) an instrument trailer. The jet pump system was initially field tested at St. Joseph, Michigan, in September 1978. The jet pump system demonstrated a capability of pumping 175 cubic yards of sand per hour and depositing it at a distance of 2,600 feet. Also during the field test the jet pump provided a bypassing capability when high wave action would have prevented the use of more conventional methods. The system can be operated by two men and has the ability to bypass at numerous harbors during a field season while minimizing mobilization and demobilization costs which would be incurred by the use of floating plant.

In the Field of River Mechanics.

1. The North Central Division Water Control Center conducted two sedimentation studies during 1977-78. These studies were supervised by Dr. C. T. Yang and aimed at providing the Corps a general sediment transport model.

The first of these studies was on the theoretical derivation of Dr. Yang's sediment transport functions expressed in the general form of:

$$\text{Log } C_t = A + B \log (VS)$$

in which C_t is the total sediment concentration, V is the velocity, S is the slope and A, B are statistically determined coefficients. A paper to present the theoretical derivations to arrive at the basic form of the equation was prepared at North Central Division, Water

Control Center, and is to be submitted to ASCE Journal of Hydraulics. After this theoretical verification, the unit stream power equation for sediment transport has been incorporated into the computer program HEC-6.

2. The second study was in connection with the GREAT-I studies. NCD was involved in providing assistance to the St. Paul District to modify the HEC-6 computer program to simulate two-dimensional flows. A semi two-dimensional mathematical model which divides the river channel and the flood plain into strips and allows the lateral movement of water and sediment is being developed. Ultimately this model will be used to study sedimentation on the Chippewa River to provide a check of a more complicated fully two-dimensional mathematical model. A simpler mathematical model, even if it would not describe the transport phenomena fully, would require less computer time and would be able to simulate longer periods of time.

Buffalo District

Lake Erie Wastewater Management Study. The Lake Erie Wastewater Management Study conducted a water quality monitoring program at 66 stations on streams tributary to Lake Erie.

One parameter measured was suspended solids. The program consisted of storm event sampling rather than continuous or periodic sampling at a regular interval. Techniques have been developed by the Lake Erie Wastewater Management Study for estimating total suspended solids loads for a year based on results of a relatively few high flow events. These techniques, using the "flow interval" method, give total annual loads comparable to those computed from daily measurements for streams with continuous stations.

Drainage area of stations included range from 1.65 square miles to 6,400 square miles. Sediment yields measured in these watersheds will be compared with estimates of gross erosion measured from the Universal Soil Loss Equation. Results will be reported in the Lake Erie Wastewater Management Study Methodology Report in March 1978.

Pollution Status of Harbor Sediments. In conjunction with the District's operation and maintenance dredging activities, the U.S. Environmental Protection agency continued to assess and evaluate 1977 harbor sediment data to determine acceptable disposal practices.

Additional analyses were conducted on sediments from Oswego Harbor, NY, and Ashtabula Harbor, OH. The cursory Oswego work resulted in a determination that an extensive sampling and analysis program will be conducted in 1979. Toxicity bioassays were conducted with Ashtabula Harbor sediments which indicated sediment toxicity at the open-lake reference and disposal sites are not exceeded at any of the harbor sites.

Bottom Sediment Study in the Cuyahoga River (Cleveland Harbor). In August 1978, sediment sampling was performed in the Cuyahoga River at Cleveland, OH. The purpose of the study was to determine in-place densities of material to be dredged. The channel bottom appears to be composed of two layers, the upper is a thin layer of saturated light material (fluff), and the lower is a more dense, less saturated material. Because of this, conventional grab sampling is inadequate for determining average density as it may or may not penetrate the upper material, and also, the material to be dredged was as much as 15-feet thick. A Shelby-Tube-type sampler was considered for the work but was not used because friction between the tube and sediment would limit the amount of material obtained.

We decided to use a Swedish Foil Sampler, a device containing a mechanism which releases metallic ribbons as a sample is drawn into a casing. This reduces friction and allows a complete core to be obtained. The longest sample recovered was 14.0 feet long.

Field density measurements were made by measuring the length of the core and weighing it in a bucket. The samples were then placed in jars and sent to a laboratory for further analyses.

A complete evaluation of the sediment data has not been made yet.

Cuyahoga River Restoration Study. The Cuyahoga River Restoration Study, Third Interim Report on Sedimentation and Erosion, is nearing completion. The study will indicate areas which are contributing sediment to the Cuyahoga River and will present methods for mitigating sediment from streambanks, point type sources, and upland areas.

Vermilion Harbor, OH. Vermilion Harbor is located about 11 miles west of Lorain Harbor on the south shore of Lake Erie. The lower half-mile of the Vermilion River plus dual lake approach channels have been dredged and protected by parallel piers and a detached breakwater in order to provide a small-boat harbor. Based on the recommendations of the January 1976 "Preliminary Report for section 111 Study of Vermilion Harbor, OH," a two-year monitoring program was initiated and in October 1977 work started on a Detailed Project Report (DPR). The DPR is scheduled for completion in September 1979.

In October 1978, topographic surveys were made. This data is in conjunction with data obtained in 1976 and 1977 and other information is being used to interpret shore processes and the impact of the detached breakwater on these processes. In April 1978, a "Study of the Impact of the Offshore Breakwater on: . . . Sedimentation, . . .:" and six other impacts was completed and, in May 1978, a "Study of the Impact of the Federal Navigation Structures on Shoreline Processes" was completed.

Lakeview Park, OH Lakeview Park is located one mile west of Lorain Harbor on the south shore of Lake Erie. In the summer of 1977 three detached offshore breakwaters plus 168,000 tons of beachfill were placed as a cooperative beach erosion control project for Lakeview Park. The beachfill was obtained from commercial offshore sources.

The Buffalo District in cooperation with CERC is involved in a five year monitoring program to document the effectiveness of these offshore breakwaters in retaining the fill and controlling beach erosion.

Hydrographic and topographic surveys were made along 32 profile lines in May and November 1978. The surveys extend 2,000 feet west and 4,500 feet east of the project. In addition, 28 sediment samples were selected in May and 60 samples in November along a 100-foot increment sampling grid. The offshore samples were collected with a Petersen sampler and the beach samples collected by hand. Sandsized samples were sent to Government testing lab for gradation analysis.

Geneva State Park, OH. Geneva State Park, located on the south shore of Lake Erie between Fairport and Ashtabula Harbors, is the site of a shore erosion demonstration project authorized under the authority of the Shoreline Erosion Control Demonstration Act of 1974. Three offshore breakwaters of various construction were installed during the Fall of 1978 to demonstrate a method of low cost shore protection.

A monitoring program is in effect to provide data for evaluating the effectiveness of the three breakwater types. Preconstruction conditions were documented by hydrographic and topographic surveys of July 1978. A survey of November 1978 documented the condition of the project area at the time of construction.

Lakeshore Park, Ashtabula, OH. Lakeshore Park is located landward of the detached Ashtabula Harbor, OH, U.S. East Breakwater. During 1978, the Buffalo District initiated a Section 103 Beach Erosion Shoreline Protection Study of Lakeshore Park at the request of the Ohio Department of Natural Resources.

During September 1978, hydrographic and topographic surveys were made and surface sediment samples taken to assist in developing the alternative designs for the Detailed Project Report. A 3,100-foot reach of shore was surveyed to approximately the 35-foot depth contour.

Presque Isle, PA. Presque Isle is a large recurved sand spit which completely shelters the harbor for Erie, PA, and functions as a very popular State park. During the spring of 1978, the Buffalo District, in cooperation with State authorities, placed 173,000 tons of sand on Presque Isle beaches as the fourth phase of a continuing emergency beach replenishment program. In addition, three experimental prototype stone breakwaters were constructed. The replenishment sand was obtained from various land sources located within a 30-mile radius of Erie, PA.

Hydrographic and topographic surveys in the vicinity of the three breakwaters (Beach 10) were made by the Buffalo District in July and November 1978 along 16 stations. In addition, 31 sediment samples were selected along a 100-foot increment sampling grid during the October 1978 survey. The information obtained from these surveys is being used to monitor the effect of the three prototype offshore breakwaters.

Irondequoit Bay, NY. Irondequoit Bay is located in Monroe County, NY, on the south shore of Lake Ontario, about four miles east of Rochester Harbor. The Buffalo District is currently performing a Phase I General Design Memorandum, Stage III, Small-Boat Harbor Study for Irondequoit Bay. This phase of the study is scheduled for completion in August 1979.

In August 1978, the District conducted a hydrographic and topographic survey of a 1,050-foot reach of shore which extend offshore to the 30-foot depth contour and of the north end of the bay. In addition, 90 surface sediment samples were taken from the lake and 19 shallow penetration sediment samples were taken from the bay. The lake samples were collected with a Petersen sampler and the bay samples with a one-inch inside diameter plastic tube manually pushed approximately six inches into the sediment. Samples were sent to Government testing lab for gradation analysis.

Sediment density measurement by means of nuclear sediment density probe. As of 1 January 1979, in-situ density measurements were updated in the following projects:

City	Project	Number of Measurements	Date
Cleveland, Ohio	Cuyahoga River	18	SEP 15
Buffalo, New York	Buffalo Harbor	10	SEP 29
	Buffalo River	16	OCT 10
	Black Rock Channel	14	SEP 29
Vermilion, Ohio	Vermilion Harbor	5	OCT 20
Sandusky, Ohio	Sandusky Harbor	10	NOV 1

Complete reports on these studies are available.

Chicago District

The Chicago District is not currently operating any sediment load sampling stations. However, two studies addressing sediment transport are underway. The studies are being conducted for the Study and Demonstration Program for an "Increase in Lake Michigan Diversion at Chicago" as authorized by Section 166 of the Water Resources Development Act of 1976.

The first study involves a bank erosion survey of the Illinois Waterway between Joliet (River Mile 285.0) and Grafton, Illinois (River mile 0.0). Bed samples were collected at approximately 40 locations in this reach and are being evaluated along with river bank soil samples to determine the nature and extent of shoreline erosion problems along the waterway. An assessment will be made as to the impacts of increased flows and velocities on bank erosion.

A second study, entitled, "Sediment Transport in the Illinois River," is being conducted to identify the sediment transport impacts of increased Lake Michigan diversion into the Illinois Waterway. The three primary objectives of the study include:

1. Based on existing data, relationships between sediment load and water discharge will be developed wherever feasible.

2. A qualitative assessment of the effects of a two-year period of increased diversion on sediment transport in the Illinois Waterway based on existing information and data will be made.

3. Recommendations will be made as to additional data requirements which will be needed to assess the effects of increased diversion on sediment transport rates of the Illinois Waterway.

Detroit District

In order to monitor beach nourishment, Peterson sampler was used to obtain samples at Ludington Harbor, St. Joseph Harbor, Holland Harbor, Muskegon and Fort Sanilac, Michigan.

Rock Island District

Sedimentation Surveys. The establishment and survey of reservoir sedimentation ranges in Lake Red Rock are about 100 percent completed. A resurvey report is scheduled to be prepared this calendar year.

The establishment and survey of reservoir sedimentation ranges in Saylorville Lake are approximately 54 percent completed.

A draft of the 1975 Sedimentation Resurvey Report at Coralville Lake on the Iowa River has been printed for review purposes.

Suspended Sediment Sampling. Suspended load sampling has been continued at 17 stations, four located on the Mississippi River and thirteen on its tributaries. Sampling at Boone, Iowa, on the Des Moines River has been discontinued and sampling at Burton, Wisconsin, on the Grant River has begun this calendar year.

Great II Sediment Sampling. In conjunction with the GREAT-II study sediment data will be gathered intermittently under contract by the USGS at eleven stations in the Rock Island District. Five of the stations are suspended load measurements only and six of the stations are bed load measurements using the Helley Smith sampler.

St. Paul District

A report on the progress and development accomplished in "A Study of Methods Used in Measurement and Analysis of Sediment Loads in Streams," conducted at the St. Anthony Falls Hydraulic Laboratory during the calendar year 1978, is described under "Laboratory and Other Research Activities."

During 1978, a siltation study was accomplished for the Homme Reservoir on the South Branch of the Park River in northeastern North Dakota. The report was prepared by the district geologist as input to the Recreation Master Plan and is in preliminary form. The purpose of the report was to evaluate and quantify the sedimentation processes within the reservoir, with emphasis on identifying the expected amount and type of sediment that may enter the pool over the next 25 years, and the sediment's impact on lake storage capacity and water depths for recreation. Possible means of managing existing sediment and future sedimentation were also to be addressed.

The study utilized surveys of seven siltation ranges conducted in 1953, 1958, 1964, 1970 and 1976, as well as borings in June 1978 at 25 lake sites, one on-land site and ten shoreline erosion sites. A topographic and geologic survey was conducted at the site of a spring erosional feature, a large supplier of sediment.

The study indicates that since the creation of Homme Reservoir in 1960, approximately 770 acre-feet, or 10.9% of the total storage capacity (7,078 acre-feet) of the reservoir, has been lost below elevation 1092 (the spillway design flood level). Below normal pool, elevation 1080, approximately 776 acre-feet, or 18.4% of the storage capacity below this elevation has been lost. Between 1953 and 1958, the sedimentation rate was 52 acre-feet per year, while from 1970 to 1976, the sedimentation rate was about 27 acre-feet per year. The drainage area above the reservoir is about 226 square miles. For the

next 25 years, the sedimentation rate is expected to remain around the 27 acre-feet per year figure, with variations possible through climatic change and man's activities. Geometrically, the sediment forms a wedge across the reservoir floor, thickest at the upstream end, and ranging from 0 to 12 feet deep.

In addition to the above, a "Report on Resurvey of Sedimentation of Homme Lake" was submitted in January.

Complete range line surveys were also undertaken at two reservoir sites in the St. Paul District during calendar year 1978. They were:

1. Eau Galle Reservoir on the Eau Galle River in Dunn County, Wisconsin.

2. Lake Ashtabula (Baldhill Dam) on the Sheyenne River in Barnes County, North Dakota.

Analysis of these two sites have not progressed sufficiently to provide any meaningful results.

Sediment load measurements are currently being made at twenty-three stations sponsored by the St. Paul District. There are sixteen stations in the Upper Mississippi River Basin and seven in the Souris - Red - Rainy Rivers Basins. Fourteen of the sediment stations in the Upper Mississippi River basin provide basic data for the Mississippi River 9-foot channel project. All sediment load measurements are being conducted by the U.S. Geological Survey under St. Paul District sponsorship.

UPPER MISSISSIPPI REGION

GEOLOGICAL SURVEY

Mississippi Headwaters Subregion

1. Suspended-sediment are being collected on a monthly basis at Mississippi River near Royalton, Minn., and at Mississippi River at Naninger, Minn., as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Mississippi River near Anoka, Minn. in cooperation with the U.S. Corps of Engineers, Great I study.

3. Suspended-sediment data are being collected on an intermittent and storm-event basis at Crow River at Rockford, Minn., and at Elk River near Big Lake, Minn., in cooperation with the Minnesota Department of National Resources, Division of Waters.

Minnesota Subregion

1. Suspended-sediment data are being collected on a daily basis at Minnesota River at Mankato, Minn., at Whetstone River near Big Stone City, S. Dak., and at Yellow Bank River near Odessa, Minn., in cooperation with the U.S. Corps of Engineers.

2. Suspended-sediment data are being collected on a monthly basis at Minnesota River near Jordon, Minn., as a part of NASQAN.

3. Suspended-sediment data are being collected on an intermittent or storm-event basis at Watonwan River near Garden City, Minn., and at Chippewa River near Milan, Minn., in cooperation with the Minnesota Department of Natural Resources, Division of Waters.

St. Croix Subregion

1. Suspended-sediment dfta are being collected on a periodic basis at the following sites:

St. Croix River at CTH "T" near Dairyland, Wis.
Namekagon River at Hayward, Wis.
Namekagon River at Trego, Wis.
St. Croix River near Danbury, Wis.
Yellow River at Danbury, Wis.
Clam River at ice house bridge near Webster, Wis.
Kettle River near Cloverdale, Minn.
Snake River near Pine City, Minn.
Apple River near Somerset, Wis.

2. Suspended-Sediment data are being collected on a monthly basis at St. Croix River at St. Croix Falls, Wis., as a part of NASQAN.

Upper Mississippi-Black-Root Subregion

1. Suspended-sediment data are being collected on a monthly and storm-event basis at North Fork Whitewater River near Elba, Minn., as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a daily basis at Zumbro River at Kellogg, Minn., at Whitewater River near Beaver, Minn., at Mississippi River at Winona, Minn., at Root River near Houston, Minn., and at South Fork Root River near Houston, Minn., in cooperation with the U.S. Corps of Engineers, Great I study.

3. Suspended and bed load-sediment data are being collected on a daily basis at Chippewa River at Durand, Wis., at Chippewa River near Carryville, Wis., at Chippewa River near Pepin, Wis., and at Black River at Galesville, Wis.

4. Suspended and bed load-sediment data are being collected on an intermittent basis at Plum Creek near Ella, Wis.

Upper Mississippi-Maquoketa-Plum Subregion

1. Suspended-sediment data are being collected on a daily basis at Upper Iowa River near Dorchester, Iowa, and at Mississippi River at McGregor, Iowa, as a part of the Great River Environmental study.

2. Suspended-sediment data are being collected at Maquoketa River near Maquoketa, Ia., as a part of the Great II River Environmental study.

3. Suspended-sediment data are being collected on an intermittent and storm-event basis at Cedar River near Austin, Minn., in cooperation with the Minnesota Department of National Resources, Division of Waters.

Wisconsin Subregion

1. Suspended-sediment data are being collected on a daily basis and bed load data on a monthly basis at Wisconsin River at Muscoda, Wis., as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic and storm-event basis at the following:

Big Eau Pleine River near Stratford, Wis.
Fenwood Creek at Bradley, Wis.
Freeman Creek at Halder, Wis.
Big Eau Pleine River near Mosinee, Wis.

3. Suspended-sediment data are being collected on an intermittent and storm event basis at North Fork Nederlo Creek near Gay Mills, Wis., at South Fork Nederlo Creek near Gay Mills, Wis., and at two locations on Nederlo Creek near Gay Mills, Wis. (Discontinued Sept, 1978)

4. Suspended-sediment data are being collected on a daily basis at the following sites:

Site A, Trout Creek near Ridgeway, Wisc.
Site B, Trout Creek near Ridgeway, Wisc.
Site C, Trout Creek near Ridgeway, Wisc.
Site D, Trout Creek near Ridgeway, Wisc.

5. Suspended-sediment data are being collected on an intermittent and event-basis at Black Earth Creek at Black Earth, Wisc.

6. Suspended-sediment data are being collected on a periodic and event-basis to determine daily suspended-sediment discharge at Yellowstone River near Blanchardville, Wisc. and at Steiner Branch near Waldwick, Wisc.

Upper Mississippi-Iowa-Skunk-Wapsipinicon Subregion

1. Suspended-sediment data are being collected on a monthly basis at Mississippi River at Clinton, Iowa, and at Mississippi River at Keokuk, Iowa, as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at the following in cooperation with the Iowa Geological Survey:

Iowa River at Iowa City, Iowa
Ralston Creek at Iowa City, Iowa
Skunk River at Augusta, Iowa

Rock Subregion

1. Suspended-sediment data are being collected on a daily plus storm-event basis on Willow Creek at Madison, Wisc.

2. Suspended-sediment data are being collected on a weekly plus storm-event basis at:

Pheasant Branch Creek at Middleton, Wisc., at U.S. Highway 12
Pheasant Branch at Century Avenue at Middleton, Wis.
Tributary to Pheasant Branch at Hwy. 14 at Middleton, Wis.
Tributary to Pheasant Branch at Airport Road at Middleton, Wis.
Pheasant Branch at Middleton, Wisc., at CTH "M"

3. Suspended-sediment data are being collected on an intermittent and storm-event basis at the following sites.

Maunesha River near Sun Prairie, Wis.
Yahara River at Windsor, Wis.
Token Creek near Madison, Wis.
Yahara River at STH 113 at Madison, Wis.

Sixmile Creek at Waunakee, Wis.
Sixmile Creek near Waunakee, Wis.
Spring Creek at CTH "M" near Middleton, Wis.
Spring Harbor Storm Sewer at Madison, Wis.
Starkweather Creek - West - at Madison, Wis.
Starkweather Creek - East - at Madison, Wis.
Olbrich Park Storm Ditch at Madison, Wis.
Door Creek near Cottage Grove, Wis.
Mt. Vernon Creek near Mt. Vernon, Wis.

4. Suspended-sediment data are being collected on a monthly basis at Rock River near Joslin, IL, as a part of NASQAN.

Des Moines Subregion

1. Suspended-sediment data are being collected on a daily basis at Des Moines River near Saylorville, IA, in cooperation with the Iowa Geological Survey.

2. Suspended-sediment data are being collected on a daily basis at Des Moines River at St. Francisville, Mo., as a part of the Great II study in cooperation with the U.S. Corps of Engineers, Rock Island District.

3. Suspended-sediment data are being collected on an intermittent basis at Des Moines River at Jackson, Minn., in cooperation with the Minnesota Department of Natural Resources, Division of Waters.

4. Suspended-sediment data are being collected on a daily basis at the following sites as a part of the Great II River Environmental study:

Crow Creek at Bettendorf, Ia.
Iowa River at Wapello, Ia.

Upper Mississippi-Salt-Subregion

1. Suspended-sediment data are being collected on a monthly basis at Mississippi River below Alton, Ill., as a part of NASQAN.

2. Suspended-sediment data are being collected on three to six storm-events per year at Middle Fabius River near Monticello, Mo., as a part of the Great II study in cooperation with the U.S. Corps of Engineers, Rock Island Districts.

Upper Illinois Subregion

1. Suspended-sediment data are being collected on a monthly basis at Illinois River at Marseilles, Ill., as a part of NASQAN.

2. Suspended-sediment data are being collected on an intermittent basis at Iroquois River near Rosebud, Ind., and at Iroquois River near Foresman, Ind., in cooperation with the State of Indiana.

3. Suspended-sediment data are being collected on a weekly basis at Kankakee River near North Liberty, Ind., in cooperation with the State of Indiana.

4. Suspended-sediment data are being collected on a daily basis at Iroquois River near Chebanse, Ill., in cooperation with the Illinois Department of Transportation, Division of Water Resources.

5. Suspended-sediment data are being collected on a daily basis at the following sites in cooperation with the Illinois Kankakee River Basin Task Force:

Kankakee River at Momence, Ill. (begun Oct. 1, 1978)
Kankakee River near Wilmington, Ill. (begun Oct. 1, 1978)
Iroquois River at Iroquois, Ill. (begun Oct. 1, 1978)

Lower Illinois Subregion

1. Suspended-sediment data are being collected on a monthly basis at Illinois River at Valley City, Ill., as a part of NASQAN.

Upper Mississippi-Kaskaskia-Meramec Subregion

1. Suspended-sediment data are being collected on a monthly basis at Mississippi River at Thebes, Ill., at Kaskaskia River at Venedy Station, Ill., at Big Muddy River at Murphysboro, Ill., and at Meramac River near Eureka, Mo., as a part of NASQAN.

2. Suspended-sediment data area being collected on a daily basis at Kaskaskia River at Cooks Mills, Ill., in cooperation with the U.S. Army Corps of Engineers, St. Louis District.

3. Suspended-sediment data are being collected on a daily basis at Mississippi River at St. Louis, Mo., in cooperation with the U.S. Army Corps of Engineers, St. Louis District.

Special Studies

Three stations are operated in cooperation with the Metropolitan Sanitary District of Greater Chicago to record changes in sediment transport during reclamation of strip-mined areas for irrigation with digested sludge from sewage treatment facilities. Two stations on Big Creek, one above the reclamation area at St. David, Ill., and one below the area near Bryant, Ill., monitor changes in sediment load. One station is operated on Slug Run near Bryant, Ill., which drains an area scheduled to be reclaimed. Annually, size analyses are run on suspended sediment at these stations.

In cooperation with the Rock Island District, Corps of Engineers, daily suspended sediment sampling began at Henderson Creek near Oquawka, Ill, and Green River near Geneseo, Ill. on April 1. At the same time at these stations and at Rock River near Joslin, Ill., sampling began for bed load and bed material sizing during high discharge events. And on December 21, daily suspended sediment sampling began at Edwards River near New Boston, Ill. All these data were gathered for the Sediment and Erosion Work Group of the Great II Mississippi River Basin Study.

Laboratory Activities

The Geological Survey laboratory in Iowa City, Ia., analyzed suspended-sediment samples collected by the Corps of Engineers at:

Mississippi River at Hannibal, Mo.
Hadley Creek at Kinderhook, Ill.
Bay Creek at Nebo, Ill.
Wapsipinicon River at DeWitt, Iowa
Iowa River at Marengo, Iowa
Iowa River at Coralville Dam, Iowa
Mississippi River at Burlington, Iowa
South Skunk River below Squaw Creek near Ames, Iowa
Mississippi River at Keokuk, Iowa
Des Moines River near Stratford, Iowa
Des Moines River near Boone, Iowa
Raccoon River at Van Meter, Iowa
North River near Norwalk, Iowa
Middle River near Indianola, Iowa
South River near Ackworth, Iowa
Des Moines River near Tracy, Iowa
White Breast Creek near Dallas, Iowa
Mississippi River at East Dubuque, Ill.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
P.O. Box 1026
605 North Neil Street
Champaign, IL 61820

District Chief, WRD
U.S. Geological Survey
1819 North Meridian Street
Indianapolis, IN 46202

District Chief, WRD
U.S. Geological Survey
P.O. Box 1230
Federal Building, Room 269
400 South Clinton Street
Iowa City, IA 52240

District Chief, WRD
U.S. Geological Survey
Post Office Building
Room 702
St. Paul, MN 55101

District Chief, WRD
U.S. Geological Survey
1400 Independence Road
Mail Stop 200
Rolla, MO 65401

District Chief, WRD
U.S. Geological Survey
1815 University Avenue
Room 200
Madison, WI 53706

UPPER MISSISSIPPI REGION

SOIL CONSERVATION SERVICE

1. Studies of sediment damages and determinations of sediment yields were made for work plans in the following watersheds:

   a. Public Law 566

Major Drainage	Watershed	Stream	County(s)	State
Kankakee River	Porter County -Kankakee	Crooked Creek and ditches	Porter	Indiana
Mississippi River	Little Wyaconda-Sugar Creek	Little Wyaconda River and Sugar Creek	Scotland Clark Lewis	Missouri
Redwood River	Tyler Creek	Tyler Creek	Lincoln Lyon	Minnesota

   b. River Basin Investigations

Major Basin	Basin Reported	State
Mississippi River	Illinois River	Illinois

Suspended and bedload sampling was conducted at the following locations by the Sediment and Erosion Work Group of the Great River Environmental Action Team, chaired by SCS:

River	Location	State
Mississippi	Anoka-Lowry Avenue Bridge	Minnesota
Mississippi	Winona-Burlington-Northern Railroad Bridge	Minnesota
Zumbro	Kellog	Minnesota
Whitewater	Near Beaver	Minnesota
Root	Near Houston	Minnesota
South Fork Root	Near Houston	Minnesota
Mississippi	McGregor	Iowa
Upper Iowa	Dorchester	Iowa

River	Location	State
Chippewa	Durand	Wisconsin
Black	Near Galesville	Wisconsin
Wisconsin	Muscota	Wisconsin

Sedimentation of surveys of Mississippi River Pools 7 and 8 were made by the Sediment and Erosion Work Group of the Great River Environmental Action Team, chaired by SCS.

c. Resource Conservation and Development

Project Name	Measure Name	County(s)	State
Blackhawk Hills	Lake Mistake	Ogle	Illinois
Two Rivers	Scripps Park	Schuyler	Illinois
Prairie Hills	Critical Area Treatment	Henderson	Illinois

2. Reservoir Sedimentation Surveys

a. A reservoir sedimentation survey was made on Shoal Creek Reservoir (Lake Lou Yeager) in Montgomery County, Illinois. The average annual rate of sediment accumulation during an 11.5-year period was 2.27 acre feet per square mile.

b. A reservoir sedimentation survey was made on the Schuester Reservoir in Washington County, Minnesota. The average annual rate of sediment accumulation during an 11-year period was 0.08 acre feet per square mile.

c. A sedimentation survey was made on the J. Vallez pond in Scott County, Minnesota. The average annual rate of sediment accumulation during a 9-year period was 0.07 acre feet per square mile.

d. Sedimentation surveys were made on the Art Olin and B. Wohlfield ponds in Wabasha County, Minnesota. The average annual rates of sediment accumulation were 0.23 acre feet per square mile during a 22-year period at the Olin pond and 0.44 acre feet per square mile during a 20-year period at the Wohlfield pond.

e. A sedimentation survey was made on the H. Hinrichs pond in Goodhue County, Minnesota. The sediment pool was found to be filled with sediment, and the trap efficiency is very low.

f. A sedimentation survey was made on Hambaugh-Martin Reservoir No. 1 in Brown County, Illinois. The average annual rate of sediment accumulation during a 16-year period was 2.20 acre feet per square mile.

g. A sedimentation survey was made on Shoal Creek Reservoir No. 1 in Montgomery County, Illinois. The average annual rate of sediment accumulation during a 13-year period has been 0.30 acre feet per square mile.

h. A sedimentation survey was made on Scripps Park Reservoir in Schuyler County, Illinois. The average annual rate of sedimentation accumulation during a 53-year period has been 0.19 acre feet per square mile.

LOWER MISSISSIPPI REGION

CORPS OF ENGINEERS

Lower Mississippi Valley Division

A major concern of the LMVD Potamology Program is sediment transport in the Lower Mississippi River. One phase of ongoing investigations was the assemblage and inventory of sediment data-collection stations throughout the Mississippi River Basin. The work was accomplished by WES and published as Technical Report M-77-1, "Inventory of Sediment Sample Collection Stations in the Mississippi River Basin," dated March 1977.

Memphis District

Twenty-four sediment sampling stations were established on the St. Francis River and its tributaries between Madison, Arkansas and Fisk, Missouri. Suspended sediment, bed sediment and flow data are being collected on a monthly basis. Suspended sediment samplers DH76TM, DH 78, D74ALTM and bed sampler BMH60 were used.

New Orleans District

Sediment Load Measurements

1. Suspended sediment and bed material samples were taken bi-weekly at the ranges located in the Mississippi River at Goochie, Louisiana; Mississippi River at Tarbert Landing, Mississippi; Old River Outflow Channel near Knox Landing, Louisiana; and Atchafalaya River at Simmesport, Louisiana. Bi-weekly samples were also taken on the Red River at Fulton, Arkansas; Shreveport, Louisiana; Alexandria, Louisiana; and above Old River Outflow Channel. Monthly samples were taken at Wax Lake Outlet at Calumet, Louisiana, and Lower Atchafalaya River at Morgan City, Louisiana. Weekly sampling was continued in the Atchafalaya Basin at ranges located at Bayou Chene below Bayou Crook Chene, Lake Long below Bayou LaRompe, Little Tensas below Blind Tensas Cut and East Access Channel above Chicot Pass.

2. Daily suspended sediment samples were taken on the Red River at Colfax, Louisiana.

3. A cooperative program with the U.S. Geological Survey for collection and analysis of suspended sediment samples was in effect for stations located on the Mississippi River at St. Francisville, Plaquemine, Union, Luling Ferry, Violet, and Venice, Louisiana. Samples were taken on the Red River at Boyce and Moncla, Louisiana. The sampling frequency was monthly and the data will be published by USGS in its annual publication.

4. Suspended sediment samples were taken with a U.S. P-46, or U.S. P-61 sampler. Bed material samples were taken with a BM-54 sampler or drag bucket type sampler. Daily suspended sediment samples were taken with a trap type sampler.

Office Investigations

1. Use of a Digital Flow-Sediment Model of Atchafalaya Basin developed in conjunction with the Hydrologic Engineering Center is continuing. The model is being used to study alternatives in preparation of the Atchafalaya Basin, Phase I GDM/Feasibility Study. This model is currently being recalibrated using data obtained from the Mississippi Basin Model in Clinton, Mississippi.

2. NOD is continuing development of a Flow-Sediment Model of the Mississippi River throughout the District.

3. A Flow-Sediment Model of the Red River Waterway is being used to study maintenance dredging associated with the construction sequence and the completed project.

4. As part of the LMVD Potamology Program (P-1), WES is compiling a report on the characterization of the suspended-sediment regime and the bed-material composition of the Mississippi River. The study is scheduled to be completed in June 1979.

5. A Computer Data Base System is being built to store Hydrographic Data for the period of record in the New Orleans District.

6. A Computer Data Base System is being written to analyze, store and retrieve sediment data.

7. For NOD, WES is preparing a physical model and a mathematical model of the Atchafalaya Bay.

8. NOD, through a contract with LSU and as part of the LMVD Potamology Program, has digitized and stored on computer tape all available hydrograph surveys in the New Orleans District.

9. As part of the LMVD Potamology Program, NOD through a contract with University of Missouri-Rolla, is documenting changes in morphological characteristics in the Mississippi and Atchafalaya Rivers.

St. Louis District

Sediment and retrogression ranges at both Rend Lake and Lake Shelbyville were surveyed in the spring of 1974. Due to higher priority work during calendar year 1978, these reports are now scheduled for submittal in calendar year 1979.

Vicksburg District

Sedimentation Surveys

1. A sedimentation survey was completed at Grenada Reservoir during the past year. The survey will be used to determine the amount and rate of sedimentation in Grenada Reservoir. The study should be completed in FY 1979.

2. Cross section and profiles were made on various streams in the Vicksburg District for use in hydrology and hydraulic studies and in design of channel improvements, levees, floodgates, pumps and other flood control and navigation features.

Sediment Load Measurements

1. In connection with Yazoo Basin Sedimentation Study, bed material, suspended sediment, temperature, discharge and stage were taken intermittently at nine stations on Big Sand Creek, Pelucia Creek, Tallahatchie River, Tillatoba Creek, Tippah River, Yallobusha River and Yazoo River.

2. In connection with potamology investigations, there are three ranges located on the Mississippi River at Vicksburg, Mississippi; Arkansas City, Arkansas; and Natchez, Mississippi; where both bed samples and suspended sediment measurements are taken weekly.

Other Investigations

1. A contract that was awarded to Colorado State University to determine the extent of the existing sediment problems in the main stem Yazoo-Tallahatchie-Coldwater River System and the effect of the proposed Upper Yazoo Projects on sedimentation in the design was completed. The model also contained a data storage retrieval system for water and sediment data. An additional study was undertaken to analyze alternatives to alleviate some of the sedimentation problems in the Greenwood Bendway. This study should be completed in 1979.

2. A comprehensive data collection program was continued as part of the Yazoo Basin Streambank Erosion Control Evaluation and Demonstration Program. This data collection program has been contracted with the Agricultural Research Service and included detailed water, sediment, and geology data collection, analysis, and evaluation on selected hill tributaries in the Yazoo Basin.

LOWER MISSISSIPPI REGION

FOREST SERVICE

National Forests in Mississippi. The Forest continued sampling streams for turbidity on 2 timber harvesting operations and 20 oil field sites.

Restoration work was completed on 47 acres of critical eroding lands resulting in an annual sediment reduction of more than 2,000 tons.

Kisatchie National Forest. A 25 acre abandoned gravel pit and a 21 acre abandoned borrow pit were rehabilitated. This resulted in reduction of annual sediment of more than 2,000 tons.

Ozark-St. Francis National Forests in Arkansas. Annual sediment yield due to forest management activities resulted in an estimated annual sediment reduction of 800 tons.

Quachita National Forest. The National Forest rehabilitated 16 acres of critical eroding lands resulting in an estimated reduction of 800 tons of sediment annually.

LOWER MISSISSIPPI REGION

GEOLOGICAL SURVEY

Lower Mississippi - Hatchie Subregion

1. Suspended-sediment data are being collected on a monthly basis at Mississippi River at Memphis, Tenn., at Obion River at Obion, Tenn., and at Hatchie River at Bolivar, Tenn., as a part of NASQAN.

Lower Mississippi - St. Francis Subregion

1. Suspended-sediment data are being collected on a monthly basis at St. Francis River at Parkin, Ark., at St. Francis Bay at Riverfront, Ark., and at White River at Clarendon, Ark., as a part of NASQAN.

Lower Mississippi - Yazoo Subregion

1. Suspended-sediment data are being collected on a monthly basis at Mississippi River near Arkansas City, Ark., at Yazoo River near Yazoo, Miss., and at Yazoo River at Redwood, Miss., as a part of NASQAN.

Lower Red - Ouachita Subregion

1. Suspended-sediment data are being collected on a monthly basis at Ouachita River at Columbia, La., and at Red River near Simmesport, La., and at Ouacita River at Camden, Ark., as a part of NASQAN. Sediment data are being collected on a monthly basis at Big Creek at Pollock, La., as a part of the National Hydrologic Benchmark Network.

Boeuf - Tensas Subregion

1. Suspended-sediment data are being collected on a monthly basis at Tensas River at Tendal, La., and at Boeut River at Fort Necessity, La., as a part of NASQAN.

Lower Mississippi - Lake Maurepas Subregion

1. Suspended-sediment data are being collected on a monthly basis at Amite River at 4-H Comp near Denham Spring, La., and at Mississippi River near St. Francisville, La., as a part of NASQAN.

Louisiana Coastal Subregion

1. Suspended-sediment data are being collected on a monthly basis at Bayou Teche at Keystone Lock and Dam below St. Martinville and at Caleasieu River below Lake Charles, La., as a part of NASQAN.

1. Suspended-sediment data are being collected on a monthly basis at Bayou Lafourche at Donaldson, La., and at Bayou Lafourche below the dam at Thibedeaux, La., in cooperation with the Louisiana Department of Public Works.

2. Suspended-sediment data are being collected on a monthly basis at the following sites as a part of NASQAN.

Mississippi River at Belle Chasse, La.
Tchefuncta River near Covington, La.
Houma Navigation Canal at Houma, La.

Special Studies

Suspended-sediment samples were collected at five sites in the Hatchie River Basin over two flood cycles and two base-flow periods. This preliminary study of land-use effects on sediment yield is in cooperation with the Tennessee Division of Water Resources.

Suspended and bedload sediment samples were collected on a tributary to the Hatchie River for a study to determine migration of pesticide residues from a landfill in Hardeman County, Tenn. The study is in cooperation with the Tennessee Department of Public Health.

In cooperation with the Tennessee Department of Transportation, the problem of scour at highway bridges is being investigated at known and potential problem sites across tennessee. Reports documenting data and research findings are planned.

Monthly collection was begun at 23 stations on the St. Francis River and selected tributaries in October 1977 for the Corps of Engineers. Monitoring is expected to continue for 5 years. Following the 5-year period, the existing network may be reduced to a few stations that would be monitored more intensively.

Suspended-sediment data are collected for selected storm events on Tillatoba Creek below Oakland and South Fork Tillatoba Creek near Charleston. This information was collected in cooperation with the U.S. Soil Conservation Service in order to estimate the sediment loads of Tillatoba Creek during periods of high discharge.

Laboratory Activities

The Geological Survey sediment laboratory located in Baton Rouge, La., analyzed suspended-sediment and bed-material samples collected by the U.S. Corps of Engineers at the following locations:

Red River at Alexandria
Old River Outflow near Knox Landing
Red River above Old River Outflow
Mississippi River at Coochie
Mississippi River at Tarbert Landing
Atchafalaya River at Simmesport
Bayou Chen above Bayou Crook Chen
East Access Channel above Lake Chicot
Lake Long below Bayou LaRompe
Little Tensas below Blind Tensas Cut
Lower Atchafalaya River at Morgan City
Wax Lake Outlet at Calumet

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Federal Office Building
Room 2301
700 West Capitol Avenue
Little Rock, AR 72201

District Chief, WRD
U.S. Geological Survey
P.O. Box 66492
6554 Florida Boulevard
Baton Rouge, LA 70896

District Chief, WRD
U.S. Geological Survey
100 W. Capitol St., Suite 710
Jackson, MS 39201

District Chief, WRD
U.S. Geological Survey
Federal Building and U.S. Courthouse
Room A-413
Nashville, TN 37203

LOWER MISSISSIPPI REGION

SOIL CONSERVATION SERVICE

1. Studies of sediment damages and determinations of sediment yields were made for work plans and environmental statements in the following watersheds:

   a. Public Law 534

Major Drainage	Watershed	Stream	County(s)	State(s)
Tallahatchie River	N. Fk. Tillatoba Creek	N. Fk. Tillatoba Creek	Tallahatchie Yalobusha	Mississippi
Tallahatchie River	N. Fk. Tillatoba Creek	Hunter Creek	Tallahatchie	Mississippi

   Special Investigations (Bedload Transport)

Major Drainage	Stream	County(s)	State(s)
Yalobusha River	Yalobusha River	Calhoun, Chickasaw, Webster, Grenada	Mississippi
Yalobusha River	Skuna River	Calhoun, Chickasaw, Pontotoc, Yalobusha	Mississippi

SOURIS-RED-RAINY REGION

CORPS OF ENGINEERS

North Central Division

St. Paul District

Sediment loads were measured by the U.S. Geological Survey at seven river stations (Wild Rice, two at Sheyenne, two at Pembina, Souris and Little South Penbina Rivers) under the St. Paul District sponsorship.

FOREST SERVICE

Critical streambanks on the Sheyenne River above Lisbon, North Dakota have been revegetated, using a community of native plants. This native plant community is reducing sedimentation into the Sheyenne.

SOURIS-RED-RAINY REGION

GEOLOGICAL SURVEY

Souris Subregion

1. Suspended-sediment data are being collected on a daily basis at Souris River near Sherwood, N. Dak., as part of the Waterways Treaty program with the U.S. Department of State.

2. Suspended-sediment data are being collected on a monthly basis at Souris River near Foxholm, N. Dak., in connection with a pre-impoundment quality water study in cooperation with the U.S. Corps of Engineers.

3. Suspended-sediment data are being collected on a monthly basis at Souris River near Westhope, N. Dak., as part of NASQAN.

4. Suspended-sediment data are being collected on a monthly basis at Souris River near Verendrye, N. Dak., and at Wintering River near Karlsruhe, N. Dak., as part of the Mississippi River Basin program.

Red Subregion

1. Suspended-sediment data are being collected on a daily basis at Sheyenne River at Lisbon, N. Dak., and at Sheyenne River at Kindred, ND, in connection with a pre-impoundment study in cooperation with the U.S. Corps of Engineers.

2. Suspended-sediment data are being collected on a monthly basis at Wild Rice River near Abercrombie, N. Dak., and at Red River of the North at Hickson, N. Dak., as part of the Missouri River Basin program.

3. Suspended-sediment data are being collected on a monthly basis at Beaver Creek near Finley, N. Dak., as a part of the National Hydrologic Benchmark Network.

4. Suspended-sediment data are being collected on a monthly basis at Red River of the North at Halstad, Minn., and at Red River of the North at Emerson, Manitoba, Canada, as a part of NASQAN.

5. Suspended-sediment data are being collected at Pembina River near Vang, N. Dak., at Little South Pembina River near Walhalla, N. Dak., and at Pembina River near Walhalla, N. Dak., in cooperation with the U.S. Corps of Engineers.

6. Suspended-sediment data are being collected on an intermittent basis at Buffalo River near Dilworth, Minn., in cooperation with the Minnesota Department of Natural Resources, Division of Waters.

7. Suspended-sediment data are being collected on a daily basis at Wild Rice River at Twin Valley, Minn., in cooperation with the U.S. Corps of Engineers.

Rainy Subregion

1. Suspended-sediment data were collected on a monthly basis at Little Fork River at Littlefork, Minn., at Roseau River below State Ditch 51 near Caribou, Minn, at Red Lake River near Crookston, Minn., and at Rainy River at Manitou Rapids, Minn., as a part of NASQAN.

Special Studies

Monthly measurements of sediment were continued during periods of flow at thirty sites in the coal regions of the State.

PS-69 sediment samplers have been installed at Lower Hay Creek Trib. and at Antelope Creek Trib. No. 4 as part of EMERIA studies. Sediment data are collected at these and several other sites in the study basins.

For additional information about Geological survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Post Office Building, Room 702
St. Paul, MN 55101

District Chief, WRD
U.S. Geological Survey
821 East Interstate Avenue
Bismarck, ND 58501

SOURIS-RED-RAINY REGION

SOIL CONSERVATION SERVICE

1. Continuing or initial studies of sediment damages and determinations of sediment yields were made for work plans in the following watersheds:

   a. Public Law 566

Major Drainage	Watershed	Stream	County(s)	State
Red River	Burnham Creek	Burnham Creek	Polk	Minnesota
Park River	North Branch Park River[1/]	North Branch Park River	Cavalier Pembina Walsh	North Dakota

[1/] Suspended sediment sampling by USGS.

MISSOURI BASIN REGION

Bureau of Reclamation

A hydrographic resurvey of Fresno Reservoir was run to be used in conjunction with the photogrammetric survey of October 1977 to provide new area-capacity relationships and volume of sediment accumulation. Thirteen sedimentation ranges were surveyed using sonar equipment for sounding and the Tellurometer CA 1000 D for fixing distance.

The Bureau of Reclamation participated with the U.S. Geologic Survey in a joint venture to resurvey Keyhole Reservoir on the Belle Fourche River in Wyoming. A survey crew reestablished sediment range markers, assisted in the hydrographic survey, and surveyed range lines which were not inundated. Twenty-four range lines were surveyed hydrographically. Horizontal position of the boat on a range line was determined using a current meter as well as by the "cutting-in" method." Depth was measured continuously along each range line using a fathometer.

Feasbility design data were reviewed for the main pumping plant of the Apple Creek Unit in North Dakota. Additional hydraulic and sediment data were determined including a rating curve for the plantsite for the 50-year projected delta conditions, a water surface profile for the 100-year flood, an estimated annual sediment load in the Missouri River at the plantsite of 6.9×10^6 m^3 (5600 acre-ft), a requirement for a settling basin capable of settling 14 000 m^3 (11 acre-ft) annually, and an estimate of 14 000 m^3 (11 acre-ft) of riverbed sediments to be removed annually to keep the entrance channel open.

MISSOURI RIVER REGION

CORPS OF ENGINEERS

Missouri River Division

Kansas City District

Sediment Load Measurements

1. Suspended sediment sampling was continued at 22 sampling stations during water year 1978. Five stations were opened in March 1978 and one was discontinued in September 1978. Three sediment sampling stations were operated on the Missouri River at St. Joseph, Kansas City, and Herman, Missouri. At these three stations, suspended depth-integrated samples were collected weekly at five vertical locations. Point samples, depth-integrated samples, and bed samples were collected once each month at the five vertical locations.

2. Suspended sediment data have been collected at seven locations on the main stem of the Kansas River. These stations were sampled biweekly as a minimum. In cooperation with the Kansas District of the U.S. Geological Survey, point, depth-integrated, and bed samples have been collected twice a month at DeSoto, Kansas, and once a month at Lecompton, Kansas. Point, depth-integrated, and bed samples have been collected by District personnel on the Kansas River at Turner, DeSoto, Eudora, Lawrence, Lecompton, Wamego, and Fort Riley, Kansas, for selected discharges.

Lake Sedimentation Investigations

1. The resurvey of Perry Lake was started last fall and will be completed in 1979. The resurvey of Rathbun Lake is scheduled for FY 1980.

2. Surveying of the initial sedimentation and degradation ranges is still in process on the following projects:

Hillsdale Lake, Kansas
Smithville Lake, Missouri
Long Branch Lake, Missouri
Harry S. Truman Reservoir, Missouri

Special Studies

1. Kansas River.

(a) The Kansas River bank stabilization study is continuing.

(b) Two longitudinal profiles of the Kansas River between the mouth and Turner bridge were taken in connection with the Kansas River navigation project. Bed samples were also collected in this reach of the river.

2. Osage River. A study, immediately downstream of Truman Reservoir, was started in 1978 to determine the effects of the power releases and pump back operations on the cohesive materials of the banks and deposited sediments in the Lake of the Ozarks.

3. Sac River. In September, six stations were monitored downstream for a complete hydropower release cycle. Data were collected continuously until a rainstorm occurred about midnight and the runoff began to interfere with the sampling. At five stations, DI sediment samples were collected and analyzed for turbidity and suspended particles at intervals of 15 minutes to 30 minutes, depending on visual inspection of the samples and hydrograph development. At Highway J, DI's, points, and velocity data were collected at the same intervals. Stage data were collected at all stations, and some velocity data were collected at various intervals above and below landowner's constructed cutoff immediately below Bear Creek.

Omaha District

Sediment Load Measurements. The measurement and computation of suspended sediment load records was continued at eight stations. Of these, two are Missouri River mainstem stations, four are major tributary stations and two are minor tributary stations. The U.S. Geological Survey operates the four major and two minor tributary stations under a cooperative stream gaging program which includes computation and publication of sediment load records. In addition, with the Corps' assistance, they collect suspended bed sediment samples, including flow velocities in the Missouri River at Nebraska City, Nebraska; Omaha, Nebraska; Sioux City, Iowa and Ponca, Nebraska. The data include five to seven point integrated samples per stream vertical at a minimum of five vertical locations in the channel cross-section, as well as one bed sample of each vertical using a BM-54 sampler. The sampling data, including the velocity measurements, are obtained from a boat at each station at about six-week intervals during the open water season. It is intended that this data will be used to document the bed material load being transported by the Missouri River. The Corps operates PS-69 automatic samplers at the two minor tributary stations in the Omaha Metropolitan area. Suspended sediment load records for stations operated under the cooperative program are published annually in the USGS Water Data reports.

Reservoir Sedimentation Activities

1. Fort Peck Project. A complete sedimentation resurvey was made of the degradation reaches below Fort Peck Dam. Observations included profiling of all degradation reach below Fort Peck Dam. Bed samples were collected for grain size determinations, and suspended sediment samples were taken at selected locations throughout the reach. A water surface profile was obtained during steady state release conditions. The resurvey data will be used to update water volume and sediment accumulation values and in determining degradation trends and bank erosion rates. Work was accomplished under private contract.

2. Garrison Project. Except for some tributary ranges which are to be resurveyed this year, a complete sedimentation resurvey was made of the aggradation reach above Garrison Dam. Scheduled observations included cross-section soundings of the aggradation ranges and sediment density measurements in the delta reach. Bed material samples and suspended sediment samples were collected in the headwater reach. This survey was made under a private contract agreement. Due to a combination of bad weather and equipment failure, part of the work had to be rescheduled under an extended contract for completion during 1979.

3. Salt Creek Project. A complete hydrographic resurvey was made of Conestoga Lake (Salt Creek Site 12), located near Lincoln, Nebraska.

Special Studies

1. A total load sediment transport function applicable for use on the Missouri River has been developed under contract by H.W. Shen at Fort Collins, Colorado, and is being coded into the HEC-6 Scour/Deposition Math Model. The function reflects time averaged conditions of stream flow and sediment transport in the Missouri River utilizing historical data collected at Yankton, South Dakota, Sioux City, Iowa, Omaha, Nebraska, and Nebraska City, Nebraska.

2. A contract was initiated with Dr. Khalid Mahmood at Rockville, Maryland, to investigate and develop a computer program package consisting of several well known sediment transport functions to determine which most accurately predicts Missouri River sediment loads. The transport functions being tested are: Einstein Bed Load Function, Colby Method, Acker-White Function, Laursen Method, Engelund-Hansen Function, Mahmood Transport Function, Meyer-Peter Muller Method, Modified Einstein Procedure, Toffaleti Method, Yang Unit Stream Power Method and Dr. Shen's Missouri Sediment Transport Function. Test data used in investigating applicability of the functions consist of conjunctive point velocity/suspended sediment samples collected at the Omaha, Nebraska, sampling station from 1965 through 1978, with the later two years being special sampling data obtained from a boat away from bridge effects.

3. A contract was initiated with Dr. William Sayre at the University of Iowa in Iowa City, Iowa, to provide an analysis of state-of-the-art information on sediment sorting and bed armoring processes, review the adequacy of mathematical sorting and armoring routines in the HEC-6 model, and, if found necessary, to develop improved routines for incorporation into the model.

4. A portable vibrating six-foot core sampler was tested in the Missouri River near Omaha, Nebraska. The sampler was initially developed by Mr. Dave W. Hubbell of the U.S. Geological Survey in Denver, Colorado. The test revealed that the sampler is useable on the Missouri River, but only in locations where coarse sand deposits exist. Because of its weight (about 400 pounds) significant modifications would be necessary before it could be used to sample submerged deposits containing high percentages of silts and clays without becoming irretrievably imbedded in the muck.

5. A study was initiated to identify the future limits and impacts of degradation in the Missouri River from Gavins Point Dam to its confluence with the Platte River. Emphasis is being given to the use of the HEC-6 Scour/Deposition Math Model to determine spatial and temporal development of channel bed armoring and stream flow-sediment load equilibrium conditions. Concurrent investigations of stage-discharge rating curve trends, spatial and temporal changes in water surface slopes, and changes in channel flow roughness are also being made. Major items of study include transient impacts of river channel bend cutoffs, channel stabilization works, changed flow regime and the degradation impacts of the dam construction.

6. Three-inch diameter core samples were taken on the Missouri River at approximately five mile intervals in the reach from Yankton, South Dakota to the Platte River confluence. The samples were taken in six-foot depth increments over a thirty-foot depth range below the thalweg of the channel. Gradations were run on each two-foot incremental sample. The results will be used to identify depths of coarse sediments or bedrock outcropping and will be used in the Missouri River Degradation Study.

7. In conjunction with the Degradation Study, and specifically to determine the tendency for coarse sediments to accumulate in dune troughs, bed material samples were collected along two selected reaches of the Missouri River near Sioux City, Iowa. The samples were taken at five-foot intervals over the crest of at least two dunes at each site. The grain size distribution was found to be about the same in both reaches with the finer sizes generally found at the crest of the dunes and the troughs producing the coarser material.

MISSOURI BASIN REGION

FOREST SERVICE

Critical flood plain and streamside zone revegetation has been completed on 1,055 acres in Montana. The river basin involved are Teton, Sun, Highwood, Shields and Squaw.

This community of native plants is reducing sedimentation in the above river basins.

MISSOURI REGION

GEOLOGICAL SURVEY

Saskatchewan Subregion

1. Suspended-sediment data are being collected on a monthly basis at St. Mary's River at Montana, U.S.A.--Alberta, Canada border, as a part of NASQAN.

Missouri-Marias Subregion

1. Suspended-sediment data are being collected on a daily basis during periods of major runoff at Big Sheep Creek near Dell, Mont., in cooperation with the U.S. Bureau of Land Management.

2. Suspended-sediment data are being collected on a daily basis at two sites on Muddy Creek near Vaughn, Mont., to monitor irrigation practices.

3. Suspended-sediment data are being collected on a monthly basis at Missouri River at Toston, Mont., and at Marias River near Chester, Mont., as a part of NASQAN.

Missouri - Musselshell Subregion

1. Suspended-sediment data are being collected on a daily basin at Missouri River near Landusky, Mont., in cooperation with the U.S. Corps of Engineers.

2. Suspended-sediment data are being collected on a monthly basis at the following as a part of NASQAN:

Missouri River at Virgelle, Mont.
Musselshell River at Mosby, Mont.
Missouri River below Fort Peck Dam, Mont.

Milk Subregion

1. Suspended-sediment data are being collected on a monthly basis at Milk River at Nashua, Mont., as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Little Peoples Creek near Hays, Mont., and Boxelder Creek near Rocky Boy, Mont., in cooperation with the Bureau of Indian Affairs.

3. Suspended-sediment data are being collected on a monthly basis at Rock Creek below Horse Creek at the international boundary, as a part of the National Hydrologic Benchmark Network.

Missouri - Poplar Subregion

1. Suspended-sediment data are being collected on a monthly basis at Redwater River at Circle, Mont., and at Redwater Creek near Vida, Mont., as a part of the Federal CBR program.

2. Suspended-sediment data are being collected on a monthly basis at Praire Elk Creek near Oswego, Mont., and at Horse Creek near Circle, Mont., in cooperation with the U.S. Bureau of Land Management.

3. Suspended-sediment data are being collected on a monthly basis at East Poplar River at international boundary in cooperation with the Department of State (International Joint Commission).

4. Suspended-sediment data are being collected on a monthly basis at the following sites to define water quality characteristics of the Poplar River Basin in cooperation with the Environmental Protection Agency:

Poplar River at international boundary
Poplar River near Scobey, Mont.
East Fork Poplar River near Scobey, Mont.
Poplar River above West Fork near Bredette, Mont.
West Fork Poplar River at international boundary
West Fork Poplar River near Bredette, Mont.
Poplar River near Poplar, Mont.

5. Suspended-sediment data are being collected on a monthly basis at Missouri River near Culbertson, Mont., as a part of NASQAN.

6. Suspended-sediment data are being collected on a monthly basis at Horse Creek near Circle, Mont., in cooperation with the U.S. Bureau of Land Management.

Upper Yellowstone Subregion

1. Suspended-sediment data are being collected on a daily basis at Yellowstone River at Billings, Mont., as a part of the Federal CBR program.

2. Suspended-sediment data are being collected on a monthly basis at Yellowstone River at Laurel, Mont., and at Yellowstone River at Huntley, Mont., in cooperation with the Environmental Protection Agency. (Huntley discontinued September 1978).

3. Suspended-sediment data are being collected on a monthly and storm-event basis from March to October at Big Sand Coulee above State ditch near Badger Basin, Wyo., in cooperation with the U.S. Bureau of Land Management.

Big Horn Subregion

1. Suspended-sediment data are being collected on a monthly basis at Beauvois Creek near St. Xavier, Mont., as part of the National Hydrologic Benchmark Network. (discontinued Sept., 1978)

2. Suspended-sediment data are being collected on a monthly basis at Bighorn River at Bighorn, Mont., as a part of NASQAN.

3. Suspended-sediment data are being collected on a monthly and storm-event basis at East Fork Wind River near Dubois, Wyo, in cooperation with the U.S. Bureau of Indian Affairs.

4. Suspended-sediment data are being collected on a monthly and storm-event basis at Wind River near Crowheart, Wyo., at Nowood River near Tensleep, Wyo., and at Shoshone River near Lovell, Wyo., in cooperation with the Wyoming State Engineer.

5. Suspended-sediment data are being collected on a daily basis at Dry Creek near Bonneville, Wyo., in cooperation with the U.S. Bureau of Land Management.

6. Suspended-sediment data are being collected on an intermittent basis at Shoshone River below Willwood Dam, near Ralston, Wyo., in cooperation with the U.S. Bureau of Reclamation.

7. Suspended-sediment data are being collected on a quarterly basis at Bighorn River at Kane, Wyo., as a part of the Missouri River Basin Program.

8. Suspended-sediment data are being collected on a daily basis at Big Coulee near Lovell, Wyo., as part of the Missouri River Basin Program.

9. Suspended-sediment are being collected on a request basis at the following sites for the U.S. Bureau of Land management.

South Fork Owl Creek near Anchor, Wyo.
Cottonwood Creek at county bridge, near Hamilton Dome, Wyo.
Cottonwood Creek at State Highway 120, near Hamilton Dome, Wyo.
Grass Creek above Little Grass Creek, near Grass Creek, Wyo.
Grass Creek near mouth, near Hamilton Dome, Wyo.
Gooseberry Creek at Dickie, Wyo.
Cottonwood Creek at Winchester, Wyo.
Gooseberry Creek at State Highway 431, near Grass Creek, Wyo.
East Fork Nowater Creek near Colter, Wyo.

Powder-Tongue Subregion

1. Suspended-sediment data are being collected on a daily basis at Tongue River at Brandenberg Bridge, Mont., at Tongue River at Miles City, Mont., and at Powder River at Locate, Mont.

2. Suspended-sediment data are being collected on a daily basis during spring runoff and summer periods at Powder River at Moorhead, Mont., and at Powder River at Broadus, Mont.

3. Suspended-sediment data are being collected on a monthly basis at Tongue River below Hanging Woman Creek near Birney, Mont., in cooperation with the Environmental Protection Agency.

4. Suspended-sediment data are being collected on a monthly storm-event basis at the following sites in cooperation with the Wyoming State Engineer:

Goose Creek below Sheridan, Wyo.
Little Powder River above Dry Creek, near Weston, Wyo.

5. Suspended-sediment data are being collected on a daily basis at Powder River at Arvada, Wyo., in cooperation with the U.S. Bureau of Land Management.

6. Suspended-sediment data are being collected on monthly storm-event basis at Clear Creek near Arvada, Wyo., in cooperation with the U.S. Bureau of Land Management.

7. Suspended-sediment data are being collected on a monthly storm-event basis at the following sites in connection with the Federal CBR program:

Salt Creek near Sussex, Wyo.
Powder River near Sussex, Wyo.
Crazy Woman Creek at upper station, near Arvada, Wyo.
Clear Creek below Rock Creek, near Buffalo, Wyo.
Clear Creek at Ucross, Wyo.
Little Powder River below Corrall Creek, near Weston, Wyo.
Little Powder River near Weston, Wyo.

Lower Yellowstone Subregion

1. Suspended-sediment data are being collected on a daily basis at Yellowstone River near Sidney, Mont., in cooperation with the U.S. Corps of Engineers.

2. Suspended-sediment data are being collected on a daily basis at Yellowstone River at Forsyth, Mont.

3. Suspended-sediment data are being collected on a monthly basis at the following sites in cooperation with the U.S. Bureau of Land Management:

East Fork Armelles Creek near Forsyth, Mont.
Armelles Creek near Forsyth, Mont.
Rosebud Creek near Kirby, Mont.
Rosebud Creek near Colstrip, Mont.
Snyder Creek near Brandenburg, Mont.
Rosebud Creek at mouth, near Rosebud, Mont.
Sarpy Creek near Hysham, Mont.
Cherry Creek near Terry, Mont.
Glendive Creek near Glendive, Mont.
Cottonwood Creek near Intake, Mont.
Burns Creek near Savage, Mont.
Beaver Creek near Wibaux, Mont.

4. Suspended-sediment data are being collected on a monthly basis at Yellowstone River at Miles City, Mont., and Yellowstone River near Terry, Mont., in cooperation with the Environmental Protection Agency.

Missouri-Little Missouri Subregion

1. Suspended-sediment data are being collected on a monthly basis at Missouri River near Williston, N. Dak., in cooperation with the Environmental Protection Agency.

2. Suspended-sediment data are being collected on a monthly basis at Bear Den Creek near Mandaree, N. Dak., as part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a monthly basis at Little Missouri River near Watford City, N. Dak., as part of NASQAN.

Cheyenne Subregion

1. Suspended-sediment data are being collected on a monthly basis at Belle Fourche River near Elm Springs, S. Dak., and at Cheyenne River at Cherry Creek, S. Dak, as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at Castle Creek above Deerfield Dam, near Hill City, S. Dak., as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a monthly and storm-event basis at Red Water Creek at Wyoming - South Dakota State line in cooperation with the Wyoming State Engineer.

4. Suspended-sediment data are being collected on a monthly and storm-event basis at Cheyenne River near Dull Center, Wyo., as a part of the U.S. Geological Survey Federal energy program.

5. Suspended-sediment data are being collected on a monthly and storm-event basis at Dry Fork Cheyenne River near Bill, Wyo., at Belle Fourche River below Moorcraft, Wyo., and at Lance Creek near Spencer, Wyo., in cooperation with the U.S. Bureau of Land Management.

6. Suspended-sediment data are being collected on a daily basis at Belle Fourche River below Rattlesnake Creek, near Piney, Wyo., and at Belle Fourche River above Dry Creek, near Piney, Wyo., in cooperation with the U.S. Bureau of Land Management.

7. Suspended-sediment data are being collected on a monthly storm-event basis at the following sites as part of the U.S. Geological Survey Federal energy program:

Antelope Creek near Teckla, Wyo.
Lodgepole Creek near Hampshire, Wyo.
Little Thunder Creek near Hampshire, Wyo.
Caballo Creek at mouth, near Piney, Wyo.
Raven Creek near Moorcraft, Wyo.
Donkey Creek near Moorcraft, Wyo.

Missouri-Oahe Subregion

1. Suspended-sediment data are being collected on a monthly basis at Spring Creek near Zap, N. Dak., in cooperation with the U.S. Environmental Protection Agency.

2. Suspended-sediment data are being collected on a monthly basis at Knife River at Hazen, N. Dak., at Grand River at Little Eagle, S. Dak., at Moreau River near Whitehorse, S. Dak., at Heart River near Mandan, N. Dak., and at Cannonball River at Breien, N. Dak., as a part of NASQAN.

3. Suspended-sediment data are being collected at Missouri River at Bismarck, N. Dak., in cooperation with the U.S. Corps of Engineers.

4. Suspended-sediment data are being collected on a monthly basis at James River at LaMoure, N. Dak., as part of the Missouri River Basin program.

Missouri- White Subregion

1. Suspended-sediment data are being collected on a monthly basis at Missouri River at Pierre, S. Dak., and at Missouri River below Ft. Randall Dam, S. Dak., as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Bad River near Ft. Pierre, S. Dak., in cooperation with the U.S. Corps of Engineers.

Niobrara Subregion

1. Suspended-sediment data are being collected on a daily basis at Niobrara River near Verdel, Nebr., in cooperation with the U.S. Corps of Engineers.

James Subregion

1. Suspended-sediment data are being collected on a monthly basis at James River near Scotland, S. Dak., as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at James River near Columbia, S. Dak.

Missouri - Big Sioux Subregion

1. Suspended-sediment data are being collected on a monthly basis at Big Sioux River at Akron, Iowa, as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at Big Sioux River near Dell Rapids, S. Dak.

North Platte Subregion

1. Suspended-sediment data are being collected on a monthly basis at Buffalo Creek near Hebron, Colo., at Grizzly Creek near Spicer, Colo. at Grizzly Creek near Hebron, Colo., at Little Grizzly Creek above Coalmont, Colo., and Little Grizzly Creek above Hebron, Colo. in cooperation with Jackson County, Colo.

2. Suspended-sediment data are being collected on a daily basis at Canadian River near Lindland, Colo., and at Canadian River near Brownlee, Colo., as a part of the Federal CBR program.

3. Suspended-sediment data are being collected on a monthly basis at North Platte River near Lisco, Nebr.

4. Suspended-sediment data are being collected on a monthly basis at Encampment River above Hog Park Creek, near Encampment, Wyo, as a part of the National Hydrologic Benchmark Network.

5. Suspended-sediment data are being collected on a monthly and storm-event basis at the following stations in cooperation with the Wyoming State Engineer:

Little Medicine Bow River near Medicine Bow, Wyo.
Medicine Bow River above Seminoe Reservoir, near Hanna, Wyo.
Sweetwater River near Alcova, Wyo.

North Platte River at Casper, Wyo.
North Platte River at Orin, Wyo.
Laramie River near Fort Laramie, Wyo.
North Platte River at Wyoming - Nebraska State line

6. Suspended-sediment data are being collected on a monthly and storm-event basis at the following stations in cooperation with the U.S. Bureau of Land Management:

Sage Creek near Saratoga, Wyo.
Big Ditch near Coyote Springs, Wyo.
North Ditch near Coyote Springs, Wyo.
Hannah Draw near Hanna, Wyo.
Sweetwater River near South Pass City, Wyo.
West Fork Crooks Creek near Jeffry City, Wyo

7. Suspended-sediment data are being collected on a monthly basis at Sand Creek near Glenrock, Wyo., for the Federal CBR program.

South Platte Subregion

1. Suspended-sediment data are being collected on a daily basis during the irrigation season April thru October at South Platte River near Weldona, Colo., starting April 1977, and bi-monthly at 15 sites on irrigation canals in the Weldona, Colo., area. This activity is in cooperation with the U.S. Bureau of Reclamation, Lower Missouri River Basin Region.

2. Suspended-sediment data are being collected on a monthly basis at South Platte River at Julesburg, Colo., as a part of NASQAN.

3. Suspended-sediment data are being collected on a monthly basis at Tarryall Creek near Jefferson, Colo., for the Federal CBR program.

4. Suspended-sediment data are being collected on a monthly basis at the following sites in cooperation with the Left Hand-St. Vrain Water Conservation District.

St. Vrain Creek at Lyons, Colo.
Left Hand Creek at mouth, at Longmont, Colo.
St. Vrain Creek below Longmont, Colo.

Platte Subregion

1. Suspended-sediment data are being collected on a monthly basis at Platte River near Duncan, Nebr.

Loop Subregion

1. Suspended-sediment data are being collected on an intermittent basis at Loop River near Genoa, Nebr.

Elkhorn Subregion

1. Suspended-sediment data are being collected on an intermittent basis during periods of high flow at Elkhorn River near Norfolk, Nebr., and Logon Creek at Pender, Nebr., in cooperation with the Nebraska Natural Resources Commission.

2. Suspended-sediment data are being collected on a miscellaneous basis at Mill Creek at Louisville, Nebr., and Cedar Creek near Louisville, Nebr., and at Four-mile Creek near Plattsmouth, Neb., in cooperation with the Nebraska Department of Water Resources.

3. Suspended-sediment data are being collected on a daily basis at Platte River at Louisville, Nebr., in cooperation with the U.S. Corps of Engineers, Omaha District.

4. Suspended-sediment data are being collected on a monthly basis at Salt Creek at Greenwood, Nebr. in cooperation with the Nebraska Natural Resources Commission.

Missouri - Little Sioux Subregion

1. Suspended-sediment data which includes bed-material, suspended-sediment samples, and velocities at several points in a vertical, are being collected at the following stations in cooperation with the Corps of Enginers, Omaha District:

Missouri River near Ponca City, Nebr. (replaces site near Sioux City, Iowa)
Missouri River at Omaha, Nebr.
Missouri River at Nebraska City, Nebr.

2. Suspended-sediment data are being collected at Missouri River at Sioux City, Iowa, as a part of NASQAN.

3. Suspended-sediment data are being collected on a miscellaneous basin at Weeping Water Creek at Weeping Water, Nebr., South Branch Weeping Water Creek near Union, Nebr., and Weeping Water Creek near Union, Nebr.

Missouri - Nishnabotna - Subregion

1. Suspended-sediment data are being collected on a periodic basis at Walnut Creek near Fairview, Kans., Walnut Creek near Hamlin, Kans., Walnut Creek at Reserve, Kans., Wolf River at Hiawatha, Kans., Buttermilk Creek

near Willis, Kans., Wolf River at Leona, Kans., Wolf River near Sparks, Kans., and at Wolf River southwest of Hiawatha, Kans., in cooperation with the U.S. Soil Conservation Service.

2. Suspended-sediment data are being collected on a daily basis at Nodaway River at Clarinda, Iowa, in cooperation with the Iowa Geological Survey.

3. Suspended-sediment data are being collected on a monthly basis at Missouri River at St. Joseph, Mo., as a part of NASQAN.

Republican Subregion

1. Suspended-sediment data are being collected on a near-monthly basis at Beaver Creek at Cedar Bluffs, Kans., South Fork Sappa Creek near Brewster, Prairie Dog Creek above Norton Reservoir, Kans., and White Rock Creek near Burr Oak, Kans., in cooperation with the Kansas Water Resources Board.

2. Suspended-sediment data are being collected on a flow rate basis at Frenchman Creek near Palisade, Neb., in cooperation with the U.S. Bureau of Reclamation.

Smoky Hill Subregion

1. Suspended-sediment data are being collected on a near-monthly basis at Smoky Hill River near Enterprise, Kans., Saline River near Tescott, Kans., Solomon River at Niles, Kans., North Fork Smoky Hill River near McAllaster, Kans., Ladder Creek below Chalk Creek near Scott City, Kans., Big Creek near Hays, Kans., North Fork Big Creek near Victoria, Kans., Saline River near Russell, Kans., North Fork Solomon River at Glade, Kans., Deer Creek near Phillipsburg, Kans., South Fork Solomon River above Webster Reservoir, Kans., and Kill Creek near Bloomington, Kans., in cooperation with the Kansas Water Resources Board.

Kansas Subregion

1. Suspended-sediment data are being collected on a near monthly basis at Kansas River at Wamego, Kans., Little Blue River near Barnes, Kans., and Stranger Creek near Tonganoxie, Kans., in cooperation with the Kansas Water Resources Board.

2. Suspended-sediment data are being collected on a periodic basis at Kansas River at Lecompton, Kans., and Kansas River at DeSoto, Kans., in cooperation with the U.S. Corps of Engineers.

3. Suspended-sediment data are being collected on a periodic basis at Sixmile Creek trib. 5 mi. NE of Auburn, Kans., Sixmile Ck. trib. 4 mi. NE of Auburn, Kans., Wakarusa River 5 mi. West of Auburn, Kans., and Wakarusa River 4 mi. west of Auburn, Kans., in cooperation with the U.S. Soil Conservation Service.

Chariton-Grand Subregion

1. Suspended-sediment data are being collected on an intermittent basis at Elk Creek near Decatur City, Iowa, as part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a monthly basis at Grand River near Summer, Mo., and at Chariton River at Praire Hill, Mo., as a part of NASQAN.

Gasconade-Osage Subregion

1. Suspended-sediment data are being collected on a near-monthly basis at Dragoon Creek near Burlingame, Kans., and Pottawatomie Creek near Garnett, Kans., in cooperation with the Kansas Water Resources Board.

2. Suspended-sediment data are being collected on a monthly basis at Osage River below St. Thomas, Mo., and at Gasconade River at Jerome, Mo., as a part of NASQAN.

Lower Missouri Subregion

1. Suspended-sediment data are being collected on a monthly basis at Missouri River at Hermann, Mo., as a part of NASQAN.

Special Studies

A study by the Kansas district is in progress to find relations between channel bed and bank material, gradient, discharge, and channel geometry for streams throughout the Missouri River basin.

Through a program in cooperation with the U.S. Bureau of Land Management to help define baseline conditions in the potential coal mining Bull Mountain region of Montana, six monthly suspended-sediment stations were established in October. In addition, sediment sampling was continued at Timber Creek near Van Norman, Mont., and at Nelson Creek near Van Norman, Mont., in cooperation with the U.S. Bureau of Land Management.

As part of the program to establish baseline data in areas of potential development for coal extraction in the Tongue and Powder River drainages of Montana, 15 sites were samples for suspended sediment. Sampling frequencies ranged from monthly on perennial streams to periodic on intermittent streams.

Sediment data are being collected at several sites in the Little Powder River basin and the adjacent Donkey Creek basin to determine the relation of suspended-sediment discharge to water discharge. The purpose is to compare the sediment yield characteristics from these two basins, one of

which has considerable mining activity and contains a rapidly growing municipality while the other is relatively untouched. Sediment data are being collected at several sites in the Rock Creek-Clear Creek drainage basin to relate suspended-sediment discharge to water discharge. The purpose is to attempt detection of changes in the sediment discharge characteristics of the stream as it heads in the mountains, flows through a municipal area, through an agricultural area, and finally through a badlands, semiarid region.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Box 25046, Mail Stop 415
Denver Federal Center
Lakewood, CO 80225

District Chief, WRD
U.S. Geological Survey
P.O. Box 1230
Federal Building, Room 269
400 South Clinton St.
Iowa City, IA 52240

District Chief, WRD
U.S. Geological Survey
1950 Avenue A-Campus West
University of Kansas
Lawrence, KS 66045

District Chief, WRD
U.S. Geological Survey
1400 Independence Road
Mail Stop 200
Rolla, MO 65401

District Chief, WRD
U.S. Geological Survey
301 South Park Avenue
Federal Building, Room 428
Drawer 10076
Helena, MT 59601

District Chief, WRD
U.S. Geological Survey
Federal Building and U.S. Courthouse
Room 406
100 Centennial Mall North
Lincoln, NE 68508

District Chief, WRD
U.S. Geological Survey
821 East Interstate Avenue
Bismarck, ND 58501

District Chief, WRD
U.S. Geological Survey
200 Fourth Street, SW
Federal Building, Room 308
Huron, SD 57350

District Chief, WRD
U.S. Geological Survey
P.O. Box 1125
J.C. O'Mahoney Federal Center
Room 5017
2120 Capitol Avenue
Cheyenne, WY 82001

MISSOURI BASIN REGION

SOIL CONSERVATION SERVICE

1. Continuing or initial studies of sediment transport, sediment damages and sediment yield were made in the following watersheds:

a. Public Law 566

Major Drainage	Watershed	Stream	County(s)	State
West Nodaway River	Hacklebarney	Direct Tributaries of West Nodaway River	Montgomery Adams	Iowa
Big Sioux River	Six-Mile Creek	Six-Mile Creek	Brookings Deuel	South Dakota
Kansas River	Wakarusa River	Wakarusa River	Douglas Osage Shawnee Wabaunsee	Kansas
Missouri River	Wolf River	Wolf River	Brown Doniphan	Kansas
Platte River	Bone Creek	Bone Creek	Bulter	Nebraska
Upper Missouri Trib.	Newlan Creek	Newlan Creek	Meagher	Montana

b. Public Law 534

Major Drainage	Watershed	Stream	County(s)	State
Little Sioux River	Smokey Hollow	Smokey Hollow	Woodbury	Iowa

c. River Basin Investigations

Major Basin	Basin(s) Reported	State
Missouri River	Northern Missouri River Tributaries	Missouri Iowa
Missouri River	Western South Dakota	South Dakota
Platte	North Platte	Wyoming

d. Resource Conservation and Development

Project Name	Measure Name	County	State
Southern Iowa	Ringgold	Ringgold	Iowa

2. Reservoir Sedimentation Surveys

   a. A sedimentation survey was made on Hayes Lake in Stanley County, South Dakota. The average annual rate of sedimentation accumulation during a 45-year period was 0.11 acre feet per square mile.

   b. A sedimentation survey was made on Lake Lakota in Lincoln County, South Dakota. Computations are not completed.

   c. Calculations completed for the K-79 and R-3 reservoirs in the Kiowa Creek Watershed, El Paso County, Colorado. Drainage areas are 3.36 square miles for K-79 and 2.84 square miles for R-3. Sediment accumulation rates are 0.12 acre-feet/square mile/year for K-79 and 0.19 acre-feet/square mile/year for R-3.

Bureau of Reclamation

A field inspection was made to evaluate sedimentation conditions at the Cimarron Diversion site for the Raton Water Supply Project in New Mexico. Cimarron Creek is armored in the vicinity of the site. Bed material samples were taken from material which had been extracted from the channel by backhoe or dragline. Suspended sediment samples were taken near the Cimarron gage and were analyzed in Denver. For preliminary planning, it was recommended that a maximum annual total sediment diversion of 260 metric tons (290 tons) be used, of which 130 metric tons (145 tons) are sand-sized or larger. It was also recommended that for an average year, a total diverted sediment of 37 metric tons (41 tons) be used, of which 18 metric tons (20 tons), is sandsized or larger.

For the Chikaskia Project a 100-year sediment volume of 69 x 10^6 m^3 (56 000 acre-ft) below the top of the conservation storage elevation 355.7 m (1167.1 ft) and an elevation of sediment of 245.5 m (1133.5 ft) at the dam were recommended for use in preparing feasibility designs.

CORPS OF ENGINEERS

Southwestern Division

Sedimentation activities of the Southwestern Division office for the calendar year 1978 were as follows:

1. The Supplement to DM No. 11, Los Esteros Lake, Sedimentation and Degradation Ranges was approved.

2. Resurveys of Fort Supply Lake and Lock and Dam No. 13, McClellan-Kerr Arkansas River Navigation System were approved.

3. ENG Form 1787 (Reservoir Sediment Data Summary Sheets) was approved for the following:

Ozark Lake	Lake Dardanelle
Pool No. 9	Pool No. 8
Pool No. 7	David D. Terry Lake
Pool No. 5	Pool No. 4
Pool No. 3	Pool No. 2

4. The SWD Laboratory received 2,283 suspended sediment samples for determination of percent sediment. There were 81 samples of bed material received to be tested for grain size distribution.

Albuquerque District

Sediment Load Measurements. Suspended sediment measurements were made on the Arkansas and Purgatoire Rivers near Las Animas, Colorado, and daily measurements were made on the Arkansas River below John Martin Reservoir and on the Purgatoire River below Trinidad Lake. A resurvey of John Martin Reservoir is scheduled for FY 1979 and that of Trinidad Lake for FY 1980.

Little Rock District

Sedimentation Surveys

1. Index ranges on Table Rock and Blue Mountain Lakes were resurveyed. The underwater portions were surveyed with Bludworth Survey Recorder.

2. Sediment ranges in Ozark Lake, Lake Dardanelle, and pools 13, 6, 5, 4 and 2 were resurveyed with Motorola automated hydrographic survey equipment.

Sediment Load Measurements. One hundred and seventy two sediment samples were obtained at 44 stations during the year.

Tulsa District

Sedimentation Survey. A resurvey of Heyburn Lake was conducted and a resurvey of Great Salt Plains was initiated in 1978. Completion is expected in the spring of 1979. A partial resurvey of Abiquiu Lake, in conjunction with the Albuquerque District was made. Written reports on the third resurvey of sedimentation and degradation at Fort Supply Lake and the first resurvey of sediment ranges on Lock and Dam No. 13 were completed and approved.

Sediment Load Measurements. The District suspended sampling program was revised to give better coverage of present areas of interest. A total of 41 stations were added, 33 stations dropped and 27 stations retained.

Other Investigations. Maintenance dredging in the McClellan-Kerr Arkansas River Navigation System during 1978 was 192,600 cubic yards. All dredging was conducted in the area immediately below W.D. Mayo Lock and Dam 14. Sediment prevention structures, designed from model studies, were installed in this area in 1977. Effectiveness of these structures is as yet unknown.

ARKANSAS-WHITE-RED REGION

FOREST SERVICE

Quachita National Forest in Arkansas. The National Forest rehabilitated 17 acres of critically eroding lands resulting in an annual decrease of about 800 tons of sediment.

Ozark-St. Francis National Forests in Arkansas. Forest management activities resulted in the annual reduction of approximately 3,700 tons of sediment.

Kisatchie National Forest in Louisiana. Critical eroding areas on 15 acres were rehabilitated resulting in an estimated annual sediment reduction of 750 tons.

National Forests in Texas. One hundred and eight acres of critical eroding national grasslands located in the Sulphur River Watershed were rehabilitated resulting in an estimated annual decrease of 3,000 tons of sediment.

ARKANSAS-WHITE-RED REGION

GEOLOGICAL SURVEY

Upper White Subregion

1. Suspended-sediment data are being collected on a monthly basis at North Sylamore Creek near Fifty Six, Ark., as part of the National Hydrologic Benchmark Network.

Upper Arkansas Subregion

1. Suspended-sediment data are being collected on a twice monthly basis at Arkansas River at Canon City, Ark., at Arkansas River at Portland, Ark., and at Arkansas River near Portland, Ark., in cooperation with the U.S. Bureau of Reclamation, Lower Missouri River Basin Region.

2. Suspended-sediment data are being collected on a monthly basis at Halfmoon Creek near Malta, Ark., as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a daily basis at Purgatoire River below Trinidad Dam, Ark., in cooperation with the U.S. Corps of Engineers, Albuquerque District.

Middle Arkansas Subregion

1. Suspended-sediment data are being collected on a near monthly basis at the following sites in cooperation with the Kansas Water Resources Board:

Arkansas River at Syracuse, Kans.
Whitewoman Creek near Leoti, Kans.
Mulberry Creek near Dodge City, Kans.
Arkansas River near Kinsley, Kans.
Guzzler's Gulch near Ness City, Kans.
Pawnee River near Larned, Kans.
Walnut Creek at Albert, Kans.
Rattlesnake Creek near Macksville, Kans.
Cow Creek near Claflin, Kans.
Blood Creek near Boyd, Kans.
Arkansas River near Hutchinson, Kans.
Little Arkansas River at Alta Mills, Kans.
Little Arkansas River at Valley Center, Kans.
North Fork Ninnescah River above Cheney Reservoir, Kans.
South Fork Ninnescah River near Pratt, Kans.
Ninnescah River near Peck, Kans.
Slate Creek at Wellington, Kans.
Cole Creek near De Graff, Kans.
Whitewater River at Towanda, Kans.
Arkansas River at Arkansas City, Kans.
Walnut River at Winfielf, Kans.

Upper Cimarron Subregion

1. Suspended-sediment data are being collected on a near monthly basis at Bear Creek near Johnson, Kans., at Cavalry Creek at Coldwater, Kans., at North Fork Cimarron River near Richfield, Kans., and Crooked Creek near Nye, kans., in cooperation with the Kansas Water Resources Board.

Lower Cimarron Subregion

1. Suspended-sediment data are being collected from Cimarron River near Buffalo, Okla., and Cimarron River at Perkins, Okla., as a part of NASQAN.

Arkansas-Keystone Subregion

1. Suspended-sediment data are being collected on a near monthly basis at Medicine Lodge River near Kiowa, Kans., in cooperation with the Kansas Water Resources Board.

2. Suspended-sediment data are being collected on a monthly basis at Arkansas River at Ralston, Okla., as a part of NASQAN.

Neosho-Verdigris Subregion

1. Suspended-sediment data are being collected at Newt Graham Lock and dam (Verdigris River) near Inola, Okla., and at Neosho River below Fort Gibson Lake near Fort Gibson, Okla., as a part of NASQAN.

Upper Canadian Subregion

1. Suspended-sediment data are being collected on a monthly basis at Canadian River near Sanchez, N. mex., in conjunction with the Water Quality Surveillance Program and in cooperation with the NMISC (New Mexico Interstate Stream Commission).

2. Suspended-sediment data are being collected on a monthly basis at Revuelto Creek near Logan, N. Mex., in cooperation with NMISC.

3. Suspended-sediment data are being collected on a monthly basis at Canadian River above New Mexico-Texas State line as a part of NASQAN.

4. Suspended-sediment data are being collected on a quarterly basis at Vermejo River near Dawson, N. Mex., in cooperation with NMISC.

Lower Canadian Subregion

1. Suspended-sediment data are being collected at Canadian River at Calvin, Okla., at Canadian River near Whitefield, Okla., and at Canadian River near Canadian, Tex., as part of NASQAN.

2. Suspended-sediment data are being collected at Blue Creek tributary near Blocker, Okla., at Blue Creek near Blocker, Okla., and at Mathuldy Creek near Crowder, Okla., for use in the BLM - EMRIA project.

3. Suspended-sediment data are being collected at Brushy Creek near Haileyville, Okla., at Peaceable Creek near Haileyville, Okla., and at Deer Creek near McAlester, Okla., for use in the coal Monitoring project.

North Canadian Subregion

1. Suspended-sediment data are being collected at North Canadian River near Wetumka, Okla., at Deep Fork near Boggs, Okla., at Beaver River near Guymon, Okla., at Beaver River at Beaver, Okla., and at North Canadian River at Woodward, Okla., as a part of NASQAN.

2. Suspended-sediment data are being collected at North Canadian River near Seiling, Okla., in cooperation with the U.S. Corps of Engineers.

Lower Arkansas Subregion

1. Suspended-sediment data are being collected on a monthly basis at Arkansas River at near Tulsa, Okla., at Arkansas River at Dam 13 near Van Buren, Ark., and at Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark., as a part of NASQAN.

2. Suspended-sediment data are being collected at the following sites for use in the BLM - EMRIA project:

James Fork near Hackett, Ark.
James Fork near Williams, Okla.
Coal Creek tributary near Bokoshe, Okla.
Coal Creek near Panama, Okla.

3. Suspended-sediment data are being collected at the following sites for use in the Coal Monitoring project:

Coal Creek near Spiro, Okla.
Fourche Maline near Wieburton, Okla.
Red Oak Creek near Red Oak, Okla.
Caston Creek at Wister, Okla.
Morris Creek at Howe, Okla.
Sugarload Creek near Monroe, Okla.
Owl Creek near McCurtain, Okla.
Huli-tuska Creek near Panama, Okla.

Red Headwaters Subregion

1. Suspended-sediment data are being collected on a monthly basis at North Fork Red River near Headrick, Okla., at Salt Fork Red River near Elmer, Okla., at Prairie Dog Town Red River near Wayside, Tex., and at and at Prairie Dog Town Fork Red River near Childress, Tex., as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at the following sites in cooperation with the U.S. Corps of Engineers:

Little Red River near Turkey, Tex.
Jonah Creek at Weir, near Estelline, Tex.
Salt Creek at County Road Bridge, near Estelline, Tex.
Salt Creek near Estelline, Tex.
East Salt Creek at County Road Bridge, near Estelline, Tex.

Red-Washita Subregion

1. Suspended-sediment data are being collected at Blue Beaver Creek near Cache, Okla., as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a monthly basis at Red River near Burkburnett, Tex., at Red River at Denison Dam near Denison, Tex., at Red River near Gainesville, Tex., and at Washita River near Durwood, Okla. as a part of NASQAN.

3. Suspended-sediment data are being collected on the periodic basis at the following sites in cooperation with the U.S. Corps of Engineers:

Wichita River near Seymour, Tex.
Red River near Quanah, Tex.
North Pease near Childress, Tex.
Middle Pease near Paducah, Tex.
Pease River near Childress, Tex.
North Wichita River near Paducah, Tex.
North Wichita River near Truscott, Tex.
South Wichita River at Ross Ranch, near Benjamin, Tex.
South Fork Wichita River near Benjamin, Tex.

Red-Sulphur Subregion

1. Suspended-sediment data are being collected from Kiamichi River near Big Cedar, Okla., as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected at Coal Creek near Lehigh, Okla., for use in the BLM - EMRIA project.

3. Suspended-sediment data are being collected at Muddy Boggy Creek at Atoka, Okla., for use in the Coal Monitoring project.

4. Suspended-sediment data are being collected on a monthly basis at Twelvemile Bayou near Dixie, La., as a part of NASQAN.

Laboratory Activities

1. The Geological Survey sediment laboratory located in Baton Rouge, La., analyzed suspended-sediment and bed-material samples collected by the U.S. Corps of Engineers at the following locations.

Red River at Fulton, Ark.
Red River at Shreveport, La.
Red River at Colfax, La.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Federal Office Building
Room 2301
700 West Capitol Avenue
Little Rock, AR 72201

District Chief, WRD
U.S. Geological Survey
1950 Avenue A - Campus West
University of Kansas
Lawrence, KS 66045

District Chief, WRD
U.S. Geological Survey
P.O. Box 66492
6554 Florida Boulevard
Baton Rouge, LA 70896

District Chief, WRD
U.S. Geological Survey
P.O. Box 26659
815 Western Bank Building
505 Marquette, NW
Albuquerque, NM 87125

District Chief, WRD
U.S. Geological Survey
201 Northwest Third Street
Room 621
Oklahoma City, OK 73102

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 649
300 East Eighth Street
Austin, TX 78701

SOIL CONSERVATION SERVICE

1. Studies of sediment damages and determinations of sediment yield were made in the following watersheds:

   a. Public Law 566

Major Drainage	Watershed	Stream	County(s)	State
Neosho River	Diamond Creek	Diamond Creek	Morris Chase	Kansas
Neosho River	South Fork Cottonwood	Cottonwood River	Butler Greenwood Chase	Kansas
Neosho River	Middle Creek	Middle Creek	Morris Chase Marion	Kansas
Neosho River	Peyton Creek	Peyton Creek	Chase	Kansas
Arkansas River	Sans Bois Cr.	Featherston Sans Bois Beaver Fish Mule Mtn. Fort	Haskell Pittsburg Latimer	Oklahoma
Arkansas River	Cimmaron R.	Turkey Cr.	Garfield Kingfisher	Oklahoma
Arkansas River	S. Canadian R.	Coal Creek	Hughes Pittsburg	Oklahoma
Arkansas River	Deep Fork	Dry Creek	Lincoln	Oklahoma
Red River	Washita River	Cherokee Sandy	Pontotoc	Oklahoma
Red River	Beaver Creek	Beaver Creek	Stephens Comanche Jefferson	Oklahoma
Red River	Afton Area	Sanders Hollow	Dickens	Texas
White River	Upper Tri-County	Caney Creek	Lawrence Sharp	Arkansas

b. Resource Conservation and Development - Sediment Yield Estimates.

Project Name	County	State
Carney Creek	Choctaw	Oklahoma

2. Reservoir Sedimentation Surveys

a. A sedimentation survey was made on Fourche Creek Reservoir No 1, in Ripley County, Missouri. Computations are not complete.

b. Sedimentation surveys were completed on Site No. 13, Lower Bayou Creek and Site No. 1, Caston Mountain Creek.

3. Non-point Pollution Studies

County erosion maps and draft Sediment Control Plans have been prepared for all of the counties within the region in New Mexico. This work was done under PL 92-500, Section 208. The Soil and Water Conservation Division of the New Mexico Resource Department is compiling the data for a state map.

An inventory of erosion, including mapping on 1/24,000 scale maps, was made on the drainage area above Ramah Reservoir in the Big Sandy Creek Watershed, Colorado. Purpose was for planning a possible 208 project.

CORPS OF ENGINEERS

Southwestern Division

Fort Worth District

The resurvey of Somerville Lake, Yegua Creek, Brazos River Basin, Texas, was completed in August 1978. Deliberate impoundment for Somerville Lake began 3 January 1967, and this first resurvey consisted of resurveying 31 of the 50 sedimentation ranges.

The installation of the sedimentation range network for Granger Dam and Lake, San Gabriel River, Brazos River Basin, Texas, was commenced in March 1978. This network will consist of 24 sedimentation and six degradation ranges when completed.

The installation of the sedimentation range network for North Fork Lake, San Gabriel River, Brazos River Basin, Texas, was commenced in March 1978. This network will consist of 18 sedimentation and five degradation ranges when completed.

Both of the above range networks are scheduled to be completed in 1979.

Galveston District

One-hundred eighteen inplace samples were obtained from four navigation projects. These samples were analyzed to determine the quality of the sediment relative to chemical constituents which would be resuspended during dredging and disposal activities. Navigation projects samples and the number of samples taken are as follows:

Navigation Project	No. Samples Taken
Gulf Intracoastal Waterway	95
Houston Ship Channel	11
Matagorda Ship Channel	9
Corpus Christi Ship Channel	3

TEXAS-GULF REGION

FOREST SERVICE

National Forests in Texas. The Forest Watershed Scientist participated with Texas A&M University in developing silvicultural BMPs.

Restoration of critical eroding lands was completed on 262 acres. Of this amount, 136 acres were rehabilitated as part of the land treatment measures for Denton Creek, a subwatershed of the Trinity River PL 534 program.

The estimated annual sediment reduction from all the critically eroding lands is about 8,000 tons annually.

Over 1,000 feet of shoreline on Lake Rayburn Reservoir was protected from erosion through use of gabion structures.

TEXAS-GULF REGION

GEOLOGICAL SURVEY

Sabine Subregion

1. Suspended-sediment data are being collected at Sabine River near Ruliff, Tex., as a part of NASQAN.

2. Suspended-sediment data are being collected on periodic basis at Cow Bayou near Mauriceville, Tex., as a part of the Federal CBR program.

Neches Subregion

1. Suspended-sediment data are being collected on a monthly basis at Neches River at Evadale, Tex. as a part of NASQAN.

Trinity Subregion

1. Suspended-sediment data are being collected on a periodic basis at West Fork Trinity River near Jacksboro, Tex., at Mountain Creek near Cedar Hill, Tex., at Duck Creek near Garland, Tex., and at Kings Creek near Kaufman, Tex., as a part of the Federal CBR program.

2. Suspended-sediment data are being collected on a monthly basis at Trinity River at Trinidad, Tex., as a part of NASQAN.

3. Suspended-sediment data are being collected on a periodic basis at Cypress Creek near Westfield, Tex., and Greens Bayou near Houston, Tex., as part of the Federal CBR program.

4. Suspended-sediment data are being collected on a daily or more frequent basis at Trinity River near Oakwood, Tex., in cooperation with the U.S. Corps of Engineers.

5. Suspended-sediment data are being collected on a monthly basis at Trinity River at Romayor, Tex., and at Chocolate Bayou near Alvin, Tex., as a part of NASQAN.

Middle Brazos Subregion

1. Suspended-sediment data are being collected at Miller Creek near Munday, Tex., at Double Mountain Fork Brazos River at Justiceburg, Tex., and at Stinking Creek near Aspermont, Tex., as a part of the Federal CBR program.

2. Suspended-sediment data are being collected on a monthly basis at Salt Fork Brazos River near Aspermont, Tex., at Brazos River near South Bend, Tex., at Brazos River near Highbank, Tex., and at Brazos River near South Bend, Tex., as a part of NASQAN.

Lower Brazos Subregion

1. Suspended-sediment data are being collected on a daily basis at Brazos River at Richmond, Tex., as part of the Federal CBR program.

2. Suspended-sediment data are being collected on a monthly basis at South Fork Rocky Creek near Briggs, Tex., as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a periodic basis at Berry Creek near Georgetown, Tex., as a part of the Federal CBR program.

4. Suspended-sediment data are being collected on a weekly or more frequent basis at Navasota River near Bryan, Tex., in cooperation with the U.S. Corps of Engineers.

5. Suspended-sediment data are being collected on a monthly basis at Brazos River near Rosharon, Tex., and at Little River near Cameron, Tex., as a part of NASQAN.

Upper Colorado Subregion

1. Suspended-sediment data were being collected on a monthly basis at Colorado River above Silver, Tex., as a part of NASQAN.

Lower Colorado-San Bernard Coastal Subregion

1. Suspended-sediment data are being collected on a periodic basis at Walnut Creek at Webberville Road, Austin, Tex., and at Onion Creek at US Hwy 183, Austin, Tex., as a part of the Federal CBR program.

2. Suspended-sediment data are being collected on a monthly basis at Colorado River at Austin, Tex., at Colorado River at Wharton, Tex., at Colorado River near San Saba, Tex., and at San Bernard River near Boling, Tex., as a part of NASQAN.

3. Suspended-sediment data are being collected on a daiy basis at Concho River at Paint Rock, Tex. and at Colorado River at Ballinger, Tex., in cooperation with Texas Department of Water Resources.

Central Texas Coastal Subregion

1. Suspended-sediment data are being collected on a monthly basis at Guadalupe River at Victoria, Tex., at San Antonio River at Goliad, Tex., and at Lavaca River near Edna, Tex., and at Mission River at Refugio, Tex., as a part of NASQAN.

Nueces-Southwestern Texas Coastal Subregion

1. Suspended-sediment data are being collected on a periodic basis at Frio River at Calliham, Tex., at Atascosa River at Whitsett, Tex., and at San Miguel Creek near Tilden, Tex., as a part of the Federal CBR program.

2. Suspended-sediment data are being collected on a monthly basis at Nueces River near Three Rivers, Tex., and at Los Olmos Creek near Falfurrias, Tex., as a part of NASQAN.

For additional information about Geological Survey activities within this region, contact the following office:

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 649
300 East Eighth Street
Austin, TX 78701

SOIL CONSERVATION SERVICE

1. Sedimentation surveys were made in the following reservoirs during 1978:

Reservoir	Major Drainage	County	State
Site 7, Clear Fork of Trinity River	Trinity River	Parker	Texas
Site 3, Deep Creek	Colorado River	McCulloch	Texas
Site 8, Deep Creek	Colorado River	McCulloch	Texas
Diversion Pond Above Site 8, Deep Creek	Colorado River	McCulloch	Texas
Site 11, Honey Creek	Trinity River	Collin	Texas
Site 9, Mukewater Creek	Colorado River	Coleman	Texas
Site 10A, Mukewater Creek	Colorado River	Coleman	Texas
Site 12, Tehuacana Creek	Brazos River	McLennan	Texas

In addition to the above reservoir surveys, approximately 30 ranges were surveyed on Lake Worth, Tarrant County, Texas, in cooperation with the City of Fort Worth. Computations are to be made by the city staff.

2. Non-Point Pollution Studies

Under PL 92-500, Section 207, county erosion maps and draft Sediment Control Plans have been prepared for all the counties within the Texas-Gulf Region in New Mexico. The Soil and Water Conservation Division of the New Mexico Natural Resources Department is sampling the data for a state map.

Bureau of Reclamation

For the Brantley Project in New Mexico an initial capacity of 1100 x 10^6 m3 (891 600 acre-ft) at maximum water surface elevation of 1006.0 m (3300.5 ft) would be reduced to 956 x 10^6 m3 (775 300 acre-ft) after 100 years of sediment deposition. With the reservoir at the top of the conservation, elevation 996.5 m (3269.5 ft), the initial water depth at the dam would be about 20.4 m (67 ft).

A field inspection was made of the Dark Canyon Siphon which had been exposed due to flooding and was in danger of failing in the event of further flooding. Scouring of 2.4 to 3.0 m (8 to 10 ft) had occurred since the construction of the siphon about 70 years ago. Attempts to place large riprap at the downstream side of the siphon have not been successful. An attempt to place stable riprap with the aid of a key trench has been contemplated.

RIO GRANDE REGION

CORPS OF ENGINEERS

Southwestern Division

Albuquerque District

Sedimentation Surveys

1. A combination sonic and land survey of Abiquiu Dam on the Rio Chama in the Rio Grande Watershed was completed in September 1978. A report on the results of this survey will be completed in 1979.

2. A combination sonic and land survey of Cochiti Lake on the Rio Grande was completed in September 1978. New area-capacity tables were issued to interested parties for use beginning 1 January 1979. Form 1787 (Sedimentation Data Summary) will be completed early in 1979. As this is the first report it will necessitate inclusion of a considerable amount of basic data but the report should be ready by July 1979.

Sediment Load Measurements. Suspended sediment measurements were made at five stations in the Rio Grande Region.

Other Investigations

1. A sediment observation system consisting of 24 reservoir sediment ranges and nine degradation ranges is being installed at Los Esteros Lake on the Pecos River, New Mexico. Installation will be completed in CY 1979.

2. Galisteo, Jemez Canyon, and Abiquiu Dams were operated to control sediment flow in the Rio Grande.

RIO GRANDE REGION

GEOLOGICAL SURVEY

Rio Grande Headwaters Subregion

1. Suspended-sediment data are being collected on a monthly basis at Rio Grande near Lobatos, Colo., as a part of NASQAN.

Rio Grande - Elephant Butte Subregion

1. Suspended-sediment data are being collected on a monthly basis at Red River at Fish Hatchery near Questa, N. Mex., in cooperation with the New Mexico Interstate Streams Commission (NMISC).

2. Suspended-sediment data are being collected on a monthly basis at Rio Chama above Abiquiu Reservoir, N. Mex., at Rio Chama below Abiquiu Dam, N. Mex., and Rio Chama near Chamita, N. Mex., in cooperation with the U.S. Corps of Engineers.

3. Suspended-sediment data are being collected on a daily basis at Rio Grande at Otowi Bridge near San Ildefonso, N. Mex., and Rio Grande near Albuquerque, N. Mex., as a part of the Federal CBR program.

4. Suspended-sediment data are being collected on a daily basis at Rio Grande below Cochiti Dam, N. Mex., in cooperation with the U.S. Corps of Engineers.

5. Suspended-sediment data are being collected on a daily basis at Galisteo Creek below Galisteo Dam, N. Mex., and at Rio Puerco near Bernardo, N. Mex., as a part of the Federal CBR program.

6. Suspended-sediment data are being collected on a monthly basis at Rio Grande at San Felipe, N. Mex., and at Rio Grande at Isleta, N. Mex., in conjunction with the Water Quality Surveillance Program and financed cooperatively by NMISC.

7. Suspended-sediment data are being collected on a daily basis at Rio Grande near Bernardo, N. Mex., at Rio Grande at San Acacia, N. Mex., and at Rio Grande at San Marcial, N. Mex., in cooperation with NMISC.

8. Suspended-sediment data for total-load determinations are being collected on a biweekly basis at Rio Grande at Albuquerque, N. Mex., at Rio Grande near Bernardo, N. Mex., at Rio Grande at San Acacia, N. Mex., and Rio Grande at San Marcial, N. Mex., in cooperation with NMISC.

9. Suspended-sediment data are being collected on a daily basis at Rio Grande Conveyance Channel at San Acacia, N. Mex., and at Rio Grande River Conveyance Channel at San Marcial, N. Mex., in cooperation with NMISC. This includes bi-weekly determination of total-sediment loads at Rio Grande Conveyance Channel at San Marcial, N. Mex.

10. Suspended-sediment data are being collected on an intermittent basis at Rio Salado near San Acacia, N. Mex., in cooperation with NMISC.

11. Suspended-sediment data are being collected on a monthly basis at Rio Grande at Anthony, N. Mex. in cooperation with NMISC.

12. Suspended-sediment data are being collected on a monthly and storm-event basis at Rio Mora near Terrero, N. Mex., as a part of the National Hydrologic Benchmark Network.

13. Suspended-sediment data are being collected on an intermittent basis at Pecos River below Sumner Dam, N. Mex. (formerly called Alamagordo Dam), in cooperation with NMISC.

14. Suspended-sediment data are being collected on a daily basis at Pecos River at Santa Rosa, N. Mex., and at Pecos River near Artesia, N. Mex., as part of the Federal CBR program.

15. Suspended-sediment data were collected on a monthly basis at Pecos River near Puerto de Luna, N. Mex., in conjunction with the Water Quality Surveillance Program and in cooperation with NMISC.

16. Suspended-sediment data are being collected on a monthly basis at Pecos River at Red Bluff, N. Mex., at Rio Grande at el Paso, Tex., and at Rio Grande at Fort Quitmon, Tex., as a part of NASQAN.

17. Suspended-sediment data are being collected on an intermittent basis at Rito de los Frijoles in Bandelier National Monument, N. Mex., in cooperation with the National Park Service.

Rio Grande - Amistad Subregion

1. Suspended-sediment data are being collected on a monthly basis at Rio Grande at Foster Ranch, near Langtry, Tex., and at Devils River at Pafford Crossing, near Comstock, Tex., as a part of NASQAN.

Rio Grande Closed Basins Subregion

1. Suspended-sediment data are being collected on a monthly basis at Rio Tularosa near Bent, N. Mex., and at Mimbres River near Mimbres, N. Mex., as a part of NASQAN.

Lower Pecos Subregion

1. Suspended-sediment data are being collected on a monthly basis at Pecos River near Langtry, Tex., as a part of NASQAN.

Rio Grande - Falcon Subregion

1. Suspended-sediment data are being collected on a monthly basis at Rio Grande at Laredo, Tex., as a part of NASQAN.

Lower Rio Grande Subregion

1. Suspended-sediment data are being collected on a daily basis at Rio Grande River near Brownsville, Tex., as part of the Federal CBR program.

2. Suspended-sediment data are being collected on a weekly or more frequent basis at North Floodway near Sebastion, Tex., and at Arroyo Colorado Floodway at El Fuste Siphon, south of Mercedes, Tex., as part of the Federal CBR program.

Special Studies

A water quality monitoring plan for the Rio Grande and Red River in Taos County, N. Mex., was initiated in October 1978 by the U.S. Bureau of Land Management. The study objectives are to monitor long-term changes in water quality (chemical and sediment) at 14 selected sampling sites. BLM personnel collect monthly samples and the Geological Survey analyzes the samples and publishes the data in the annual water-supply reports.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Box 25046, Mail Stop 415
Denver Federal Center
Lakewood, CO 80225

District Chief, WRD
U.S. Geological Survey
P.O. Box 26659
815 Western Bank Building
505 Marquette, NW
Albuquerque, NM 87125

District Chief, WRD
U.S. Geological Survey
Federal Building
Room 649
300 East Eighth Street
Austin, TX 78701

SOIL CONSERVATION SERVICE

Studies of gully and streambank erosion were made in the following watershed.

Public Law 566

Major Drainage	Watershed	Stream	County	State
Upper Rio Grande	Rito Seco	Rito Seco	Costilla	Colorado

Non-Point Pollution Studies

County erosion maps and draft Sediment Control Plans have been prepared for all the counties within the Rio Grande Region in New Mexico. This work was done under PL 92-500, Section 208. The Soil and Water Conservation Division of the New Mexico Natural Resources Department is compiling data for a state map.

UPPER COLORADO REGION

Bureau of Reclamation

A report was written entitled "Effect of Dolores Project in Sediment Transport of Lower Dolores River." The report describes the many variables involved in sediment transport and river morphology and how they are affected by construction of an upstream dam. On the lower Dolores River below McPhee Dam reduction in streamflow will not influence the historic sediment transport because the channel is presently stable with most reaches having a gravel and cobble streambed. The tributary inflow of predominately clay and silt size material will move on through the channel as suspended load.

Summaries of hydrometeorology, flood hydrology, and sedimentation reviews were prepared and presented to representatives of Tippets-Abbett-McCarthy-Stratton for the following dams:

Blue Mesa Dam
Crystal Dam
Red Fleet Dam
Shasta Dam
Keswick Dam
Starvation Dam
Sugar Pine Dam

A 100-year sediment accumulation of 2.06×10^6 m^3 (1670 acre-ft) was estimated for Kendig Reservoir on West Divide Creek in Western Colorado. The estimated depth of sediment at the dam for this volume is 6.2 m (20.4 ft) to an elevation of 2050.7 m (6727.9 ft). Degradation in the tailwater reach is estimated to be negligible. These estimates were for feasibility designs.

A 100-year sediment volume of 92 100 m^3 (74.7 acre-ft) was approved for use in preparing feasibility designs for Dry Hollow Reservoir on Dry Hollow Creek. The 100-year depth of sediment at the dam is estimated to be 4.8 m (15.7 ft).

The 100-year estimate of sediment accumulation for Saltado Reservoir is 2.13×10^6 m^3 (1732 acre-ft) for an estimated elevation of sediment at the dam of 2139.4 m (7019 ft). This quantity of sediment represents a yield rate of 29.2 m^3/km^2 (0.00915 acre-ft/mi^2) per year.

Degradation estimated to be 0.2 m (0.5 ft) downstream of Dominguez Reservoir was approved for use in preparing feasibility and specifications designs. A 100-year sediment volume of 59.3×10^6 m^3 (48 100 acre-ft) was distributed with depth of sediment at the dam of

11.9 m (39 ft) to be considered for designs. The depth of sediment at the inlet to the Rim Basin Pumping Plant is to be determined using a longitudinal profile scheme when the location of the inlet is finally decided.

Scour estimates for specifications designs and estimates varied from 0.9 to 3.0 m (3.0 to 10.0 ft) for the Fountain Valley Conduit and Pumping Access Roads.

Specifications design data and revised sediment deposition values were reviewed for collection ditches uphill from the Government Highline Canal for the Stage 1 area. The effect that sediment carried in the canal would have on laterals and metering devices in the Stage 1 area based on silts and clays carried in suspension would be minimal. Estimated scour for Big Salt Wash Siphon was 1.2 to 1.5 m (4 to 5 ft) as controlled by shale. Sediment yield was estimated using the following function: Sediment Yield = 1.36 x Drainage Area$^{-0.113}$.

FOREST SERVICE

Colorado River Region. Wasatch National Forest personnel, as part of the Barometer Watershed Program, have completed two sediment studies reported on previously. One report deals with the impact of reservoir construction on water quality with special emphasis on suspended sediment. The other report explains outcome of attempts to remotely sense suspended sediment concentrations and yield in the East Fork of Smith's Fork. Copies of the reports are available from the Wasatch National Forest, Salt Lake City, Utah.

UPPER COLORADO REGION

GEOLOGICAL SURVEY

Colorado Headwaters Subregion

1. Suspended-sediment data are being collected on a daily basis by automatic pumping samplers at West Tenmile Creek at Wheeler Junction, Colo., at Black Gore Creek near Vail, Colo., and Gore Creek at Vail, Colo., in cooperation with the Colorado Department of Highways.

2. Suspended-sediment data are being collected at Colorado River near Deboque, Colo., in cooperation with the Colorado River Water Conservation District.

3. Suspended-sediment data are being collected on a monthly basis at Parachute Creek near Grand Valley, Colo,, in cooperation with the Environmental Protection Agency.

4. Suspended-sediment data are being collected on a daily basis at Parachute Creek near Grand Valley, Colo., and at Roan Creek near Deboque, Colo., as a part of Federal sedimentation study in oil shale areas.

5. Suspended-sediment data are being collected on a daily basis at East Middle Fork Parachute Creek near Rio Blanco, Colo., and East Fort Parachute Creek near Rulison, Colo., in cooperation with the U.S. Navy.

6. Suspended-sediment data are being collected on a monthly basis at Colorado River near Colorado-Utah State line as a part of NASQAN.

Gunnison Subregion

1. Suspended-sediment data are being collected on a monthly basis at Gunnison River near Grand Junction, Colo., as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at the following sites as a part of the USGS coal hydrology program:

Anthracite Creek near Somerset, Colo.
Spring Creek near Beaver Hill, Colo.
Spring Creek near Montrose, Colo.

Upper Colorado-Dolores Subregion

1. Suspended-sediment data are being collected on a comprehensive level at Colorado River near Cisco, Utah.

2. Suspended-sediment data are being collected on a monthly basis at Beaver Creek near Norwood, Colo. and San Miguel River at Naturita, Colo., as a part of the USGS Coal Hydrology Program.

Great Divide-Upper Green Subregion

1. Suspended-sediment data are being collected on a monthly and storm-event basis at the following sites as a part of the U.S. Geological Survey Federal Energy Program:

Green River at Warren Bridge, near Daniel, Wyo.
Green River near Big Piney, Wyo.
Pine Creek above Freemont Lake, Wyo.
East Fork River near Big Sandy, Wyo.
Sand Springs Draw tributary near Boulder, Wyo.
New Fork River near Big Piney, Wyo.
Dry Basin Creek near Big Piney, Wyo.
LaBarge Creek near LaBarge Meadows ranger station, Wyo.
Fontenelle Creek near Herschler ranch, near Fontenelle, Wyo.
Green River below Fontenelle Reservoir, Wyo.
Fourmile Gulch tributary near Fontenelle, Wyo.
Big Sandy River at Lechkie Ranch, near Big Sandy, Wyo.
Little Sandy Creek above Eden, Wyo.
Big Sandy River at Gasson bridge, near Eden, Wyo.
East Otterson Wash near Green River, Wyo.
Green River at Big Island, near Green River, Wyo.
Skunk Canyon Creek near Green River, Wyo.
Deadman Wash near Point of Rocks, Wyo.
Salt Wells Creek near South Baxter, Wyo.
Gap Creek above Beans Spring Creek, near South Baxter, Wyo.
Beans Spring Creek near South Baxter, Wyo.
Beans Spring Creek at mouth, near South Baxter, Wyo.
Big Flat Draw near Point of Rocks, Wyo.
Cutthroat Draw near Rock Springs, Wyo.
No Name Creek near Rock Springs, Wyo.
Blacks Fork near Millburne, Wyo.
East Fork of Smith Fork near Robertson, Wyo.
West Fork of Smith Fork near Robertson, Wyo.
Smith Fork near Lyman, Wyo.
Mud Spring Hollow near Church Butte, near Lyman, Wyo.
Blacks Fork near Lyman, Wyo.
Hams Fork below Pole Creek, near Frontier, Wyo.
Meadow Springs Wash tributary near Green River, Wyo.
Blacks fork tributary number 2 near Green River, Wyo.
Blacks Fork tributary number 3 near Green River, Wyo.
Blacks Ford tributary number 4 near Green River, Wyo.
Summers Dry Creek near Green River, Wyo.
Squaw Hollow near Burntfork, Wyo.
Green River tributary number 2 near Burntfork, Wyo.
Burnt Fork near Burntfork, Wyo.
Henrys Fork near Manila, Utah

2. Suspended-sediment data are being collected on a daily basis at Green River near Green River, Wyo. as a part of the U.S. Geological Survey Federal Energy Program.

3. Suspended-sediment data are being collected at the following sites on a monthly and storm-event basis in cooperation with the Wyoming State Engineer:

Green River near LaBarge, Wyo.
Big Sandy River near Farson, Wyo.
Big Sandy River below Eden, Wyo.
Hams Fork near Granger, Wyo.
Blacks Fork near Little America, Wyo.

4. Suspended-sediment data are being collected at the following sites on a monthly and storm-event basis in cooperation with the U.S. Bureau of Land Management:

Bitter Creek near Bitter Creek, Wyo.
Bitter Creek above Salt Wells Creek, near Salt Wells, Wyo.
Gap Creek below Beans Spring Creek, near South Baxter, Wyo.
Dry Canyon near South Baxter, Wyo.
Salt Wells Creek near Salt Wells, Wyo.
Little Muddy Creek near Glencoe, Wyo.
Muddy Creek near Hampton, Wyo.
Vermillion Creek near Hiawatha, Colo.

5. Suspended-sediment data are being collected on a daily basis at Separation Creek near Riner, Wyo. in cooperation with the U.S. Bureau of Land Management.

6. Suspended-sediment data are being collected on a monthly and storm-event basis at Separation Creek at upper station, near Riner, Wyo., and Delaney Draw near Red Desert, Wyo. in cooperation with the U.S. Bureau of Land Management.

7. Suspended-sediment data are being collected on a monthly basis at Vermillion Creek at Inn Springs Ranch, Colo., as a part of the USGS Coal Hydrology Program.

White-Yampa Subregion

1. Suspended-sediment data are being collected on a monthly and storm-event basis at Little Snake River near Dixon, Wyo. in cooperaration with the Wyoming State Engineer.

2. Suspended-sediment data are being collected on a storm-event basis at Dry Cow Creek near Baggs, Wyo. as a part of the Federal energy program.

3. Suspended-sediment data were obtained on a monthly basis at Yampa River near Maybell, Colo., and at Little Snake River near Lily, Colo., as a part of NASQAN.

4. Suspended-sediment data are being collected on a daily basis at Yampa River near Maybell, Colo., and on a weekly basis at Little Snake River near Lily, colo., in cooperation with the Colorado River Water Conservation District.

5. Suspended-sediment data are being collected at several sites in the coal mining region of the Yampa River basin. Two stations are equipped with pumping samplers and where the flow is continuous, daily samples are collected. The following stations are operated at the indicated frequencies:

Middle Creek above Foidel Creek, Colo.	Monthly
Foidel Creek at Fish Canyon Road, Colo.	Monthly
Foidel Creek at mouth near Oak Creek, Colo.	Daily
Jubb Creek near mouth, Colo.	Monthly
Taylor Creek at mouth near Axial, Colo.	Monthly
Good Springs Creek near Axial, Colo.	Weekly
Wilson Creek below Taylor Creek near Axial, Colo.	Daily
Stokes Gulch near Hayden, Colo.	Daily

These stations are funded by the Bureau of Land Management.

6. Suspended-sediment data are being collected at several stations in the Piceance Creek basin to monitor the potential impact of the oil shale development project. All stations are equipped with pumping sediment samplers and where the flow is continuous, daily samples are collected. Intermittent stations are designed to sample all significant peaks and low flow samples are collected when possible. The following stations are operated at the indicated frequency:

Piceance Cr. bl. Rio Blanco, Colo.	Daily
Stewart Gulch above West Fork, Colo.	Daily
W. F. Stewart Gulch at mouth, Colo.	Peaks
Sorghum Gulch at mouth nr. Rio Blanco, Colo.	Peaks
Cottonwood Gulch nr. Rio Blanco, Colo.	Peaks
Piceance Cr. trib. nr. Rio Blanco, Colo.	Peaks
Scandard Gulch at mouth, Colo.	Peaks
Willow Cr. nr. Rio Blanco, Colo.	Daily
Piceance Cr. above Hunter Cr., Colo.	Daily
Black Sulfur Cr. nr. Rio Blanco, Colo.	Daily
Piceance Cr. bl. Ryan Gulch, Colo.	Daily
Piceance Cr. at White River, Colo.	Daily
Stake Springs Draw nr. Rangely, Colo.	Peaks
Corral Gulch bl. Water Gulch, Colo.	Peaks
Dry Fk. nr Rangely, Colo.	Peaks
Box Elder Gulch nr. Rangely, Colo.	Peaks
Trib. to Box Elder Gulch nr. Rangely, Colo.	Peaks

Corral Gulch nr. Rangely, Colo.	Daily
Corral Gulch at 84 Ranch, Colo.	Peaks
Yellow Cr. trib. at 84 Ranch, Colo.	Peaks

These stations are operated in cooperation with the Colorado River Water Conservation District.

7. Suspended-sediment data are being collected on a monthly basis at White River below Meeker, Colo., and White River above Rangely, Colo., in cooperation with the Environmental Protection Agency, and on a weekly basis at White River above Rangely, Colo., from May 1 to September 30 in cooperation with the Colorado River Water Conservation District.

8. Suspended-sediment data are being collected on a monthly basis at North Fork White River at Buford, Colo., and South Fork White River at Buford, Colo., and on a daily basis at Douglas Creek near mouth near Rangely, Colo., in cooperation with the Northwest Colorado Council of Governments.

9. Suspended-sediment data are being collected on a comprehensive level at White River near Colorado-Utah State line in cooperation with the Utah Department of Natural Resources.

10. Suspended-sediment data are being collected on a comprehensive level at White River near mouth near Ouray, Utah, in cooperation with the U.S. Bureau of Land Management.

11. Suspended-sediment data are being collected on a monthly basis at Yampa River below Diversion, near Hayden, Colo., at Yampa River below Craig, Colo., at Williams Fork at mouth, near Hamilton, Colo., and at Yampa River below Elkhead, near Craig, Colo., in cooperation with the Environmental Protection Agency.

12. Suspended-sediment data are being collected on a periodic basis at Horse Draw near Rangely, Colo., and at Horse Draw near mouth, near Rangely, Colo., in cooperation with the U.S. Bureau of Mines.

Lower Green Subregion

1. Suspended-sediment data are being collected on a comprehensive level at Green River near Jensen, Utah and at Green River at Green River, Utah.

Upper Colorado - Dirty Devil Subregion

1. Suspended-sediment data are being collected on a twice monthly basis at Colorado River at Lees Ferry, Ariz., in cooperation with the U.S. Bureau of Reclamation.

2. Suspended-sediment data are being collected on a monthly basis at Paria River at White House Ruins, Utah, at Paria River below Water Pockets, Ariz. and at Paria River at Lees Ferry, Ariz., in cooperation with the U.S. Bureau of Land Management.

San Juan Subregion

1. Suspended-sediment data are being collected on a monthly basis at Vallecito Creek near Bayfield, Colo., as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a comprehensive level at Fremont River near Cainville, Utah, in cooperation with the Utah Department of Natural Resources.

3. Suspended-sediment data are being collected on a daily basis at Animas River at Farmington, N. Mex., and at San Juan River at Shiprock, N. Mex., as a part of the Federal CBR Program.

4. Suspended-sediment data are being collected on a monthly basis at La Plata Creek at Colorado-Utah state line and at McElmo Creek at Colorado-Utah state line as a part of the USGS Coal Hydrology Program.

5. Suspended-sediment data are being collected on a comprehensive level at San Juan River near Bluff, Utah.

Special Studies

A "Techniques of Water Resources Investigation" publication is being prepared on pumping suspended-sediment samplers. Questionnaries have been sent to about 25 Districts using such samplers. The inquiry was aimed at gathering operating experience with suspended-sediment pumping samplers. Many types of samplers are being used in the field, and an evaluation of each type will be included in the T.W.R.I.

An energy project "Hydrologic Surveillance of Coal Lease Areas in Northwestern New Mexico" was continued. Sediment stations were established throughout the coal lease areas and are financed by Federal CBR and U.S. Bureau of Land Management funds.

As part of the program for the determining baseline conditions in the areas of potential oil-shale development in the White River basin, Utah suspended-sediment data continued to be obtained monthly at 11 sites and during times of flow at 4 sites. This work is in cooperation with the Environmental Protection Agency, the U.S. Bureau of Land Management and the Utah Department of Natural Resources.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Federal Building
301 West Congress Street
Tucson, AZ 85701

District Chief, WRD
U.S. Geological Survey
Box 25046, Mail Stop 415
Denver Federal Center
Lakewood, CO 80225

District Chief, WRD
U.S. Geological Survey
P.O. Box 26659
815 Western Bank Building
505 Marquette, NW
Albuquerque, NM 87125

District Chief, WRD
U.S. Geological Survey
P.O. Box 1125
J. C. O'Mahoney Federal Center
Room 5017
2120 Capitol Avenue
Cheyenne, WY 82001

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 8002
125 South State Street
Salt Lake City, UT 84138

SOIL CONSERVATION SERVICE

An erosion map on 1/50,000 scale was prepared for Eagle County, Colorado.

Sediment yield and erosion rate estimates were made for the Red Creek Watershed tributary of Green River in Sweetwater County, Wyoming.

LOWER COLORADO REGION

Bureau of Reclamation

The cross-drainage and scour study for the bypass pipeline was approved for use in preparing specifications designs. Scour estimates varied from 0.9 to 1.5 m (3.0 to 5.0 ft).

A meeting was held in Amarillo, Texas, to establish criteria for collection of sediment and channel hydraulic data for the San Juan River environmental study below Navajo Dam.

Tailwater and sediment studies were revised to reflect a change in the Cottonwood damsite location. A sediment yield rate of 6390 m^3/km^2 (2.0 acre-ft/mi^2) per year was used.

In Reach 1 of the Granite Reef Aqueduct, design of sediment traps for the Bouse Hills and Little Harquahala Pumping Plants were reviewed. Due to windblown sand from sand dunes upstream from the Bouse Hills Pumping Plant, it was recommended that the sediment trap be revised to accommodate 2290 m^3 (3000 yd^3). A sediment trap having a capacity of 340 m^3 (450 yd^3) was approved for the Little Harquahala Pumping Plant.

Hydrologic Design Data were reviewed for Reach 3 of the Granite Reef Aqueduct. Sediment inflow was determined using the Southwest United States sediment yield curve which states: Sediment Yield = 2.4 x Drainage $Area^{-0.229}$. Sediment yield varied from 3260 to 7380 m^3/km^2 (1.02 to 2.31 acre-ft/mi^2) per year. Also for Reach 3 of the Granite Reef Aqueduct, it was concluded from trial analysis that previously approved 100-year sediment estimates could be divided by two to yield the 50-year sediment inflow amounts. Trap efficiencies for overchute inverts set at the top and bottom of the sediment pool were determined using Churchill's method

The Southwest United States sediment yield curve Sediment Yield = 2.4 x Drainage $Area^{-0.229}$ was used to estimate yield for cross drainage in Reach 8 of the Granite Reef Aqueduct. Scour estimates for both upstream and downstream ends of each of the cross-drainage structures were determined for use in preparing specifications designs.

A scour estimate was made for use in replacing a power pole which was undercut during March 1978 flooding. The scour was estimated to be 4.5 m (15 ft) using a 100-year flood peak of 3400 m^3/s (120 000 ft^3/s), channel width of 880 m (2900 ft), and d_m of 0.5 mm. Mean channel velocity was 2.3 m/s (7.6 ft/s).

LOWER COLORADO REGION

GEOLOGICAL SURVEY

Lower Colorado-Lake Mead Subregion

1. Suspended-sediment data are being collected on a monthly basis at the following sites in cooperation with the U.S. Bureau of Land Management:

Virgin River near Bloomington, Utah
Virgin River above I-15 Rest Area, Ariz.
Virgin River below I-15 Rest Area, Ariz.
Virgin River at Mouth of Narrows, Ariz.
Virgin River at Littlefield, Ariz.

2. Suspended-sediment data are being collected on a periodic basis at the following sites:

Las Vegas Wash near Boulder City, Nev.
Virgin River at Littlefield, Ariz.
Virgin River above Halfway Wash near Riverside, Nev.

3. Suspended-sediment data are being collected at North Fork Virgin River above Zion Narrows, near Glendale, Utah., in cooperation with the Utah Department of Natural Resources.

Little Colorado Subregion

1. Suspended-sediment data are being collected on a monthly basis at the following sites in cooperation with the Arizona Department of Health Services:

Little Colorado River at Greer, Ariz.
Little Colorado River above Lymon Lake, near St. Johns, Ariz.
Showlow Creek near Lakeside, Ariz.

2. Suspended-sediment data are being collected on a daily basis at Moenkopi Wash near Moenkopi, Ariz.

Lower Colorado Subregion

1. Suspended-sediment discharge are being collected at the following sites in cooperation with the Bureau of Land Management:

Boulder Creek above Copper Creek, near Bagdad, Ariz.
Copper Creek near mouth, near Bagdad, Ariz.
Boulder Creek near mouth, near Bagdad, Ariz.
Burro Creek above Boulder Creek, near Bagdad, Ariz.

Burro Creek at US 93 Bridge, near Bagdad, Ariz.
Big Sandy River near Wikieup, Ariz.
Bill Williams River near Planet, Ariz.
Burro Creek at old US 93 Bridge, near Bagdad, Ariz.

2. Suspended-sediment data are being collected on a monthly basis at Colorado River below Parker Dam, Arizona-California, and at Yuma Main Drain at Southerly International Boundary, near San Luis, Ariz., in cooperation with the Arizona Department of Health Services.

Upper Gila Subregion

1. Suspended-sediment data are being collected on a monthly storm-event basis at Mongollon Creek near Cliff, N. Mex. as a part of the National Hydrologic Benchwork Network.

2. Suspended-sediment data are being collected on a monthly basis at Gila River near Redrock, N. Mex., and at San Francisco River near Glenwood, N. Mex. in cooperation with New Mexico Interstate Streams Commission.

3. Suspended-sediment data are being collected on a monthly basis at the following sites in cooperation with the Arizona Department of Health Services:

Gila River near Clifton, Ariz.
San Francisco River near Clifton, Ariz.
Gila River at Head of Safford Valley, near Salomon, Ariz.
Gila River at Calva, Ariz.

Middle Gila Subregion

1. Suspended-sediment data are being collected on a monthly basis at the following sites in cooperation with the Arizona Department of Health Services:

Gila river at Winkleman, Ariz.
San Pedro River at Winkleman, Ariz.
Gila River at Kelvin, Ariz.
Santa Cruz River at Rio Rico, Ariz.

2. Suspended-sediment data are being collected on a weekly basis at Santa Cruz River near Nogales, Ariz., in cooperation with the Arizona Water Commission.

Salt Subregion

1. Suspended-sediment data are being collected on a monthly basis at the following sites, in cooperation with the Arizona Department of Health Services:

Black River near Fort Apache, Ariz.
White River near Fort Apache, Ariz.
Salt River near Roosevelt, Ariz.
Tonto Creek above Gun Creek, near Roosevelt, Ariz.
Verde River above Clarkdale, Ariz.
Oak Creek at Sedona, Ariz.
Oak Creek at Red Rock Crossing, near Sedona, Ariz.
Oak Creek near Cornville, Ariz.
Verde River near Camp Verde, Ariz.
Gila River below Gillespie Dam, Ariz.

2. Suspended-sediment data are being collected on a monthly basis at Wet Bottom Creek near Childs, Ariz., as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a monthly basis at 16 sites as a part of NASQAN.

Special Studies

Sediment data were collected during periods of flow at two small watersheds in the area of strip mining along Coal Mine Wash and Coal Mine Wash at mouth near Kayenta, Ariz., as part of a study pertaining to the effects of strip mining and rehabilitation of spoil piles on the sediment yield.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Federal Building
301 West Congress Street
Tucson, AZ 85701

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 227
705 North Plaza Street
Carson City, NV 89701

District Chief, WRD
U.S. Geological Survey
P.O. Box Box 26659
815 Western Bank Building
505 Marquette, NW
Albuquerque, NM 87125

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 8002
125 South State Street
Salt Lake City, UT 84138

LOWER COLORADO REGION

SOIL CONSERVATION SERVICE

Studies of erosion and sedimentation were made in the following river basins.

River Basin Investigations

Major Basin	Basin Reported	State
Lower Colorado	Little Colorado River	Arizona New Mexico
Lower Colorado	Virgin River	Arizona

Critically eroding areas were identified.

Non-Point Pollution Studies

County erosion maps and draft Sediment Control Plans have been prepared for all the counties within the Lower Colorado Region in New Mexico. This work was done under PL 92-500, Section 208. The Soil and Water Conservation Division of the New Mexico Natural Resources Department is compiling the data for a state map.

Sedimentation Surveys

A base survey was made to monument Fredonia Reservoir, Fredonia Watershed, Coconino County, Arizona. Land use and erosion studies were made of the watershed area.

Bureau of Reclamation

A 100-year sediment accumulation of 2.24 x 10^6 m^3 (1820 acre-ft) was approved for Jordanelle Reservoir. This sediment volume represents less than 1 percent of the original reservoir capacity of 394.7 x 10^6 m^3 (320 000 acre-ft). Therefore, approval was given to place the outlet works 3.0 m (10 ft) above streambed with no storage allocation for sediment.

A field inspection of sedimentation and erosion problems on Diamond Fork and Main Creeks near Provo, Utah, was made to evaluate channel conditions and erosion associated with various choices for water releases from Strawberry Reservoir into the Provo River System.

Scour estimates for the four crossings along the Jordan Aqueduct, schedule No. 4, were estimated to be 1.8, 2.1, 1.2, and 1.8 m (6, 7, 4, and 6 ft) for areas 14-E, 15-E, 20-E, and 21-E, respectively.

It was estimated that the 16-ha (40-acre) pond at the Vat Diversion Dam would have to be dredged about once every 8 years. For the West Fork Pipeline, a scour depth of 1.5 m (5.0 ft) is to be used for all crossings, except the West Fork Duchesne River crossing, where a scour depth of 2.7 m (9.0 ft) is to be used. It was further recommended that backfill material for the pipeline is to be of material similar to that presently there, since riprap induces turbulence and subsequent local scouring.

GREAT BASIN REGION

GEOLOGICAL SURVEY

Bear Subregion

1. Suspended-sediment data are being collected on a monthly and storm-event basis at Twin Creek at Sage, Wyo., in cooperation with the U.S. Bureau of Reclamation.

Great Salt Lake Subregion

1. Suspended-sediment data are being collected on a monthly basis at Red Butte Creek at Fort Douglas, near Salt Lake City, Utah, as part of the National Hydrologic Benchmark Network.

Black Rock Desert-Humboldt Subregion

1. Suspended-sediment data are being collected periodically at Quinn River near McDamott, Nev., at Humboldt River at Imlay, Nev., and at Humboldt River at Rye Patch Dam, Nev., in cooperation with the Nevada Division of Water Resources.

Central Lahontan Subregion

1. Suspended-sediment data are being collected periodically at Truckee River near Nixon, Nev., at Martis Creek near Truckee, Calif., at Carson River at Fort Churchill, Nev., and at Walker River near Wabuska, Nev., as part of the Federal CBR program.

Central Nevada Desert Basins Subregion

1. Suspended-sediment data are being collected periodically at Chiatovich Creek near Dyer, Nev., at Steptoe Creek near Ely, Nev., and at South Twin River near Round Mountain, Nev., as part of the Federal CBR program.

Special Studies

An investigation of fluvial sediment hazards to potential urban areas was continued in cooperation with the Nevada Vureau of Mines and Geology. The initial area of study was Washoe Valley, a suburban valley between the urban areas of Reno and Carson City. Similar work has also been done in the South Lake Tahoe Area, Carson City area, and in Las Vegas Valley. Results are shown as maps of potentially hazardous areas with respect to both flooding and sediment transport, and are published by the Nevada Bureau of Mines and Geology.

Several flash floods occurred in non-populated areas of Nevada during the past year, but sediment transport by those floods was not investigated.

A sediment-transport simulation model developed by J. P. Bennett and C. F. Nordin, Jr. (1977) was used to predict bedload and suspended-sedi ment transport and channel-bed scour and fill at selected sites in the East Fork Carson River in Carson Valley, Nevada. The model incorporates an unsteady, nonuniform-flow computation component, a means of simulating bedload and suspended-sediment transport and their interactions, and bed-armoring and elevation-accounting routines. The model was calibrated using 50 days of streamflow and sediment data collected during spring 1978 from a 10.5 mile reach of the East Fork Carson River. An interpretive open-file report is in review.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 227
705 North Plaza Street
Carson City, NV 89701

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 8002
125 South State Street
Salt Lake City, UT 84138

District Chief, WRD
U.S. Geological Survey
P.O. Box 1125
J. C. O'Mahoney Federal Center
Room 5017
2120 Capitol Avenue
Cheyenne, WY 82001

PACIFIC NORTHWEST REGION

Bureau of Reclamation

A field inspection was made of the Osoyoos, Cordell, and Crater Lakes, and Ellisford, Tonasket, and Bonaparte Pumping Plant sites for final location on the Similkameen or Okanogan Rivers with respect to stream channel morphology, sediment movement, and geology. Later, a meeting was held to discuss removal of sediment from Okanogan and Similkameen River waters at the pumping plants prior to delivery into the irrigation system. It was decided to make comparative cost estimates of two schemes: one includes a settling basin and the other would employ a graded intake filter. Further, a model study of the Cordell Pumping Plant was proposed which would be completed in the Hydraulic Laboratory at the Engineering and Research Center in Denver, which would provide data for designing an intake filter.

PACIFIC NORTHWEST REGION

CORPS OF ENGINEERS

North Pacific Division

Portland District

Sediment sampling was conducted at stations on Rogue and Umpqua Rivers for post-impoundment and for planning and design purposes, respectively. Data are being maintained on suspended sediment, bed load, dissolved solid, temperature, turbidity, conductivity, pH and dissolved oxygen.

Information on sedimentation ranges is listed below:

Project: Lost Creek Reservoir

Activity: Installing monuments and surveying sedimentation ranges. All 22 designated ranges have been surveyed and tied in. The draft report will be finalized by 1 October 1979.

Purpose: Initial survey of reservoir and upstream and downstream channels for later evaluation of aggradation, degradation, and siltation.

Type of Survey: Range Survey

Elements Measured: Position of monuments, profile of ground surface and river sections.

Equipment Used: Survey scope.

Seattle District

The following table indicates the reservoir sediment range resurveys made in 1978:

Project	Ranges Resurveyed
Albeni Falls	none
Chief Joseph	none
Howard A. Hanson	24
Libby	12
Mud Mountain	19
Wynoochee	10

Walla Walla District

The following ranges were resurveyed:

1. Lucky Peak Reservoir. All 34 ranges.

2. McNary Reservoir.

(a) Yakima River Ranges 1 and 2.

(b) Seven ranges across the Columbia River at the mouth of the Walla Walla River.

(c) Twenty-one ranges across the Columbia River from Wallula to Richland area.

The suspended sediment and bedload sampling program at the stream gaging stations, Snake River near Anatone and Clearwater at Spalding, has not changed since last year and is planned to continue through 1979.

FOREST SERVICE

Payette and Bois National Forest personnel continue to measure channel cross sections and bottom core samples in the major salmon spawning areas on the South Fork Salmon River. In addition, suspended sediment and bedload are measured on several tributaries to evaluate the extensive watershed restoration efforts which were completed several years ago.

PACIFIC NORTHWEST REGION

GEOLOGICAL SURVEY

Kootenai-Pend Oreille-Spokane Subregion

1. Suspended-sediment data are being collected on a periodic basis from Pend Orielle River at international boundary and at Spokane River at Long Lake, Wash., as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at Ross Creek near Troy, Mont., at Stanley Creek near Troy, Mont., and at Lake Creek near Troy, Mont., in cooperation with the Montana Department of Fish and Game.

3. Suspended-sediment data are being collected on a daily basis at Kootenai River near Copeland, Idaho, as part of the U.S. Geological Survey waterways-treaty program.

4. Suspended-sediment data are being collected on a bimonthly basis at Hayden Creek above North Fork near Hayden Lake, Idaho, as a part of the National Hydrologic Benchmark Networks.

5. Suspended-sediment data are being collected at various flow rates at South Fork Cour d'Alene River at Kellogg, Idaho, in cooperation with the Idaho Department of Water Resources.

Upper Columbia Subregion

1. Suspended-sediment data are being collected on a periodic basis at Columbia River at Northport, Wash., and at Columbia River at Vernita Bridge, near Priest Rapids Dam, Wash., as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at Andrews Creek near Mazama, Wash., as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a daily basis at Flathead River at Flathead, B.C., and at North Fork Flathead River near Columbia Falls, Mont., in cooperation with the Environmental Protection Agency and as a part of NASQAN.

4. Suspended-sediment data are being collected on a quarterly basis at Columbia River at Richland, Wash.

5. Suspended-sediment data are being collected on a daily basis from irrigation return flows at three sites and from irrigation delivery flows at twenty-two sites on the Royal Slope in Washington.

6. Suspended-sediment data are being collected on a daily basis from EL 68 wasteway near Othello, Wash.

Yakima Subregion

1. Suspended-sediment data are being collected on a daily basis at Yakima River at Kiona, Wash., as a part of NASQAN.

2. Suspended-sediment data are being collected at various flow rates at South Fork Cour d'Alene River at Kellogg, Idaho, at Lapwai Creek near Lapwai, Idaho, and at Palouse River near Potlatch, Idaho, in cooperation with the Idaho Department of Water Resources.

3. Suspended-sediment data are being collected on a bimonthly basis at Hayden Creek above North Fork near Hayden Lake, Idaho, as a part of the National Hydrologic Benchmark Networks.

Upper Snake Subregion

1. Suspended-sediment data are being collected on a monthly basis at Cache Creek near Jackson, Wyo., as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a monthly basis and at Snake River near Heise, Idaho, as a part of NASQAN.

3. Suspended-sediment data are being collected on a periodic basis at Teton River near Drigg, Idaho, at Blackfoot River near Blackfoot, Idaho, at Portneuf River near Blackfoot, Idaho, at Portneuf River and at Bruneau River near Hot Spring, Idaho, in cooperation with the Idaho Department of Water Resources.

Middle Snake Subregion

1. Suspended-sediment data are being collected at various flow rates at Snake River at King Hill, Idaho, as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at Big Jacks Creek near Bruneau, Idaho, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a periodic basis at Mores Creek near Arrowrock Dam, Idaho, and at Weiser River near Weiser, Idaho, in cooperation with the Idaho Department of Water Resources.

Lower Snake Subregion

1. Suspended-sediment data are being collected on a monthly basis at Salmon River near White Bird, Idaho, and Clearwater River at Spalding, Idaho, as part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at Lapwai Creek near Lapwai, Idaho, and at Palouse River near Potlach, Idaho, in cooperation with the Idaho Department of Water Resources.

3. Suspended-sediment data are being collected at Snake River at Burbank, Wash., as a part of NASQAN.

4. Suspended-sediment data are being collected on a periodic basis at Minam River at Minam, Oreg., as a part of the National Hydrologic Benchmark Network.

Middle Columbia Subregion

1. Suspended-sediment samples are being collected on a monthly basis at John Day River near McDonald Ferry, Oreg., at Klickitat River near Pitt, Wash., and at Deschutes River near Biggs, Oreg., as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Bear Creek near Prineville, Oreg., in cooperation with the U.S. Bureau of Land Management.

Lower Columbia Subregion

1. Suspended-sediment data are being collected on a monthly basis at Columbia River at Warrendale, Oreg., and at Cowlitz River at Kelso, Wash., as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at three sites on the Cowlitz River in Oregon.

3. Suspended-sediment data are being collected on a daily basis at Bull Run River near Multnomah Falls, Oreg., and at Fir Creek near Brightwood, Oregon, in cooperation with the city of Portland, Oreg., to provide some information needed to define the effects of activities in the basin.

Willamette Subregion

1. Suspended-sediment data are being collected on a monthly basis from Tualatin River at West Linn, Oreg., and at Willamette River at Portland, Oreg., as a part of NASQAN.

Oregon-Washington Coastal Subregion

1. Suspended-sediment data are being collected on a monthly basis at Rogue River near Agress, Oreg., at Umpqua River near Elkton, Oreg., at Nehalam River near Foss, Oreg., at Chehalis River at Porter, Wash., and at Queets River near Clearwater, Wash., as a part of NASQAN.

2. Suspended-sediment data are being collected at North Fork Quinault River near Amanda Park, Wash., as part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected at Soleduck River at mouth near La Push, Wash., at Bogachiel River near La Push, Wash., at Calawah River at mouth near Forks, Wash., at Dickey River near Mora, Wash., at Waatch River at Neah Bay, Wash., at Sooes River near Ozette, Wash.

4. Suspended-sediment data are being collected on a daily basis by an automatic sampler at Elliott Creek near Copper, Oreg., in cooperation with the U.S. Forest Service.

5. Suspended-sediment data are being collected on a daily basis by automatic samplers at Rogue River below Prospect, Oreg., at South Fork Rogue River, south of Prospect, Oreg., and at Rogue River at McCloud, Oreg., in cooperation with the U.S. Corps of Engineers.

6. Suspended-sediment data are being collected on a periodic basis at Big Butte Creek near McCloud, Oreg., at Elk Creek near Trail, Oreg., and Rogue River at Dodge Bridge, Oreg.

Puget Sound Subregion

1. Suspended-sediment data are being collected on a periodic basis at Elwha River at McDonald Bridge near Port Angeler, Wash., at Skagit River near Mount Vernon, Wash., and at Puyallup River at Puyallup, Wash., as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at four sites in May Creek drainage.

3. Suspended-sediment data are being collected on a miscellaneous basis in the Bellevue Urban Study Area.

Oregon Closed Basins Subregion

1. Suspended-sediment data are being collected on a monthly basis at Donner and Blitzen River near Frenchglen, Oreg., as a part of NASQAN.

Special Studies

As part of a continuing investigation of the hydrologic environment in the upper Salmon River, periodic suspended-sediment data were collected representing high, medium, and low flows at five selected tributaries. Previous to the investigation, which began in 1973, no sediment data were available for this part of Idaho. This data, plus other water-quality parameters, are being collected to indicate the general quality of water

from a delicately balanced ecosystem and to determine possible stream degradation from numerous mining activities and poor road maintenance practices throughout the area. The White Cloud Peaks region is known for scenic vistas and primitive pristine character.

During 1978, suspended and bedload-transport data were collected in the Snake and Clearwater Rivers in the vicinity of Lewiston, Idaho.

Failure of the Teton Dam (June 5, 1976) drastically altered the geomorphic character of the existing Teton Valley river systems. During the 1978 discharge year, some 500 suspended-sediment samples were collected. Resurveyed reaches and bedload samples indicate a less than expected channel change. Although coarse material is available for transport as bedload, hydraulic properties are thought to be in equilibrium with corresponding cross-sectional bedload rates. The majority of fine material (less than 0.062 mm) is transported throughout the reach. Natural impoundments upstream will capture coarse material transported from upstream channel changes (Teton River). However, where meanders were eliminated, lateral erosion can be expected. The final report is planned for release in early 1979.

For additional information about Geological Survey activities within this region, contact the following offices:

District Chief, WRD
U.S. Geological Survey
Box 036
Federal Building, Room 365
550 West Fort Street
Boise, ID 83724

District Chief, WRD
U.S. Geological Survey
301 South Park Avenue
Federal Building, Room 428
Drawer 10076
Helena, MT 59601

District Chief, WRD
U.S. Geological Survey
830 Northeast Holladay Street
Portland, OR 97232

District Chief, WRD
U.S. Geological Survey
1201 Pacific Avenue, Suite 600
Tacoma, WA 98402

District Chief, WRD
U.S. Geological Survey
P.O. Box 1125
J. C. O'Mahoney Federal Center
Room 5017
2120 Capitol Avenue
Cheyenne, WY 82001

PACIFIC NORTHWEST REGION

SOIL CONSERVATION SERVICE

1. Studies of erosion and sediment yields were made in the following watersheds.

   a. Watersheds

Major Drainage	Watershed	Stream	County	State
Salt River	Dry Creek-Cottonwood Creek		Lincoln	Wyoming
	East Wenatchee		Douglas	Washington

   b. River Basin Investigations

Major Basin	Basin Reported	State
Columbia	Upper Snake River	Idaho Wyoming
North Coast Drainage	Tillamook	Oregon

   c. Non-point Pollution Studies

   Non-point Pollution Studies (208) were conducted in Wasco, Sherman, Gilliam, Morrow, and Umatilla Counties, Oregon.

   d. Miscellaneous

   The U.S. Geological Survey, under a cooperative agreement, monitored the Teton River and will publish results.

   A water monitoring program, under contract to the Idaho Department of Health, on Rock Creek, Power County, Idaho will continue during the 1978-79 season.

   County erosion maps for the Upper Snake River Basin were digitized and placed in the RAP computer at Fort Collins, Colorado by the U.S. Forest Service.

2. Sedimentation Survey

The sediment survey and watershed evaluation on Cooper Creek reservoir in Sutherlin Creek Watershed, Douglas County, Oregon was completed. Between June 1969 and February 1977 sediment deposition in the reservoir averaged 0.55 acre feet/square mile/year from a drainage area of 4.2 square miles.

Bureau of Reclamation

A review was made of a report prepared by the California Department of Water Resources entitled "Grass Valley Creek Sediment Control Study, April 1978 - Buckhorn Mountain Damsite - Trinity River Basin Fish and Wildlife Action Program." The study shows a low peak flood of 170 m^3/s (6000 ft^3/s) for the design of a spillway and a sediment deposition in the reservoir of about 23 000 m^3 (19 acre-ft) per year for a 24.6 km^2 (9.5 mi^2) drainage. A reservoir with 1.36 x 10^6 m^3 (1100 acre-ft) available for sediment storage may have a useful life of greater than the 50 years indicated in the report becuase of trap efficiency and allowance for finer sediments.

CALIFORNIA REGION

CORPS OF ENGINEERS

South Pacific Division

Los Angeles District

Sediment surveys were conducted at twenty-three debris basins. Reservoir Sedimentation Data Summary Sheets (ENG Form 1787) for these projects are completed. These basins are: Aliso, Blanchard, Bluegum, Brace, Cooks Canyon, Dunsmuir, Eagle, Hall's, Kinneloa-West, May No. 1, May No. 2, Oak, Pinelawn, Rowley, Rubio, Shields, Sierra Madre Villa, Snover, Starfall, Sturtevant, Sunset Canyon (Upper), Verdugo and Zachau.

Sacramento District

Routine samples of lake outflow were collected and analyzed for suspended sediment at Black Butte, Pine Flat, Isabella, Kaweah and Success Lakes.

Detailed surveys of sediment ranges at Lake Kaweah and Success Lake were completed during 1977. Results of the surveys are submitted on ENG Form 1787.

San Francisco District

Sedimentation activities during 1978 consisted of obtaining sediment transport and turbidity data projects in various stages of development. These activities are summarized below:

Sedimentation Studies for Water Resources Projects

1. There are five cooperative sediment sampling stations currently in operation in the San Francisco District, including a station on Pena Creek in the Russian River Basin that went into operation in the 1979 Fiscal Year. Bedload sampling was added to the existing Dry Creek near Geyserville suspended sediment sampling station in 1978. Data from these five stations will be used to evaluate the effects of the Coyote Dam-Lake Mendocino and Warm Springs Dam-Lake Sonoma Projects on the sedimentation characteristics of Dry Creek and the Russian River and to evaluate the sediment transport characteristics of Wildcat Creek and Corte Madera Creek. The data gathered on Wildcat Creek and Corte Madera Creek will be used to develop maintenance requirements associated with the authorized flood control projects on these streams.

2. A program designed to monitor the turbidity of inflow to and releases from Lake Mendocino has been in operation since March 1973. Measurements are made bi-weekly by reservoir operations personnel under the guidance of the U.S. Geological Survey (USGS). The data are then published in the USGS Water Supply Papers.

3. The turbidity monitoring program being conducted for the Warm Springs Dam-Lake Sonoma Project was continued in 1978. Water quality samples taken four times a year at four stations above the damsite are analyzed for turbidity data being gathered at the cooperative sediment sampling station, Dry Creek near Geyserville.

CALIFORNIA REGION

GEOLOGICAL SURVEY

Klamath - Northern California Coastal Subregion

1. Lumbering and sawmill operations at the preriphery of Redwoods National Park, Calif., may load the streams entering the park with sediment and unwanted nutrients. A study is being made to determine the present rates of sediment transport, the chemical quality, and the level of nutrients of the streams at the periphery and within the park, and to provide an overall appraisal of water resources in the park. Two data releases covering the period September 1, 1973, through September 30, 1975, have thus far been published. The study will aid the National Park Service in developing and protecting the water resources and ecological system in the park. Work is being done in cooperation with the National Park Service.

2. The Grass Valley Creek project is a continuing total-load data-collection program in cooperation with the California Department of Water Resources. The study was begun in 1976 to determine the amount of sediment contributed by Grass Valley Creek to the Trinity River below Lewiston Dam. The study was expanded during 1978 to determine the effect of reservoir release flows on removal of sand-size sediment from a reach of the Trinity River near its confluence with Grass Valley Creek.

Sacramento Subregion

1. A report on the trap efficiency of Highland Creek Reservoir near Kelseyville, Calif., is in preparation. This study was made in cooperation with the U.S. Soil Conservation Service.

2. The Cottonwood Creek project is a continuing total-load data-collection program for the U.S. Corps of Engineers. Sediment data are being collected to determine sediment discharge at two dam sites and at a site near the mouth of Cottonwood Creek. Suspended-sediment samples from the dam sites are being tested in a settling column.

3. The Sacramento River Bank Stabilization Project is a data-collection program for the U.S. Corps of Engineers. The purpose of the study is to determine sediment sources and sinks and modes of transport for the Sacramento River and major tributaries of the Sacramento. During 1978, total-load data were collected at 10 sites and suspended-load data were collected at 3 sites.

4. The Delta Turbidity Project is a continuing data-collection program in cooperation with the California Department of Water Resources. The purpose of the project is to determine suspended-sediment discharge and turbidity for the Sacramento and San Joaquin Rivers near their mouths.

5. The Peripheral Canal Sediment Project is designed to provide sediment-transport information in the vicinity of the proposed Peripheral Canal Diversion site near Hood, Calif. In 1978, periodic data were obtained to determine the vertical and lateral variability in velocity, suspended-sediment concentration, and percentage of sand in suspension. The study was made in cooperation with the California Department of Water Resources.

San Francisco Bay Subregion

1. A report on sediment transported by streams tributary to San Francisco Bay, Calif., is in preparation. Short-term sediment discharge records were used to estimate annual sediment discharge during the period 1909-66.

2. A combination scientific and land-use planning analysis of Napa and Sonoma Counties in the San Francisco Bay, Calif., region is being prepared as a culmination of geomorphic studies begun in 1971. The analysis is based on a four-step procedure that defines the relations among terrain properties, land use activities, and erosional problems. The four steps are: (1) identification of land use activities, (2) collation of the critical physical factors that control land-surface stability, (3) mapping of erosional and depositional features, and (4) production of a matrix relating land-use activities to erosional and depositional province disturbance potential. Study is part of the USGS-HUD San Francisco Bay, Calif., Regional Study.

3. Sediment-yield and water-quality conditions in an urbanized basin and in two relatively un-urbanized subbasins were monitored through May 1978 to determine changes caused by urbanization. A modified version of the U.S. Geological Survey rainfull-runoff model was used in the study to simulate storm flows at ungaged sites where periodic sediment samples were obtained. This study was made in cooperation with the Santa Clara Valley District. Results of the first 3 years of study (1973-75) were published in the following report:

> Interim report on streamflow, sediment discharge, and water quality in the Calabazas Creek Basin, Santa Clara County, California, by Knott, J. M., Pederson, G. L., Middelburg, R. F., 1978, Menlo Park, Calif., U.S. Geological Survey Water Resources Inv. 78-2, 41p.

Central California Coastal Subregion

A study to determine the effect of the Marble Cone Fire (August 1977), near Big Sur, Calif., on sedimentation in Los Padres Reservoir near Carmel Valley is underway. Reservoir surveys were made in November 1977 and September 1978, and storage capacities have been calculated. This study was made in cooperation with the Monterey Peninsula Water Management District and the U.S. Forest Service.

Southern California Coastal Subregion

1. A report, "Estimate of sediment discharge in the Santa Clara River Basin, California, by Rhea P. Williams, has been submitted for approval and release to the open file.

2. The project, "Effects of river modifications and control structures in the Santa Clara River Basin, Ventura and Los Angeles counties, California," is in progress. The study will document the effects of river-control structures and of sand-and-gravel mining on streamflow, phreatophyte growth, channel morphology, and sediment transport in the Santa Clara River basin. Sediment delivery to the shoreline and sediment size, quantity, and relation to beach stability will also be examined.

For additional information about Geological Survey activities within this region, contact the following office:

District Chief, WRD
U.S. Geological Survey
855 Oak Grove Avenue
Menlo Park, CA 94025

SOIL CONSERVATION SERVICE

Non-Point Pollution Study (208)

Studies were completed on eight pilot areas and data expanded over Central Valley, California for the Central Valley Regional Water Quality Board. Erosion and sediment yield was determined and estimates made of potential reductions in erosion and sediment due to implementation of Best Management Practices.

Sediment clean out data was obtained for two debris basins representing sediment accumulation for one year.

Debris Basin	County	Drainage Area (sq. mi)	Sediment Removed (cu. yds.)
Santa Monica	Santa Barbara	3.7	19,379
Gabbert	Ventura	3.1	44,350

ALASKA REGION

CORPS OF ENGINEERS

North Pacific Division

Alaska District

The sediment transport study for the Tanana River near Fairbanks was continued into 1978. The rating curve for suspended and bedload sediment established in the 1977 open water season received supporting information from last year's sampling. The study program is funded by the Corps of Engineers through a cooperative agreement with the U.S. Geological Survey and is used to evaluate gravel extraction effects on the Tanana River.

The remaining sediment samples gathered during calendar year 1978 were procured through our cooperative stream gaging program with the USGS. Results of this program will be reported in the 1978 Water Resources Data for Alaska.

FOREST SERVICE

Alaska Region

A network of soil and water monitoring stations has been operated to quantify sediment yield from undisturbed forest lands and those under management. Suspended sediment, bedload and turbidity data have been collected. Along with monitoring, a range of landforms and stream channel characteristics are being inventoried to determine differences in sediment production and sensitivity to management. Other activities include site restoration to reestablish vegetation on high sediment yield areas, and studies to evaluate alternative techniques to reduce accelerated sedimentation.

Tongass National Forest

a. Chatham Area: Seven monitoring stations were operated, six of which were in cooperation with the Geological Survey. Sediment and turbidity monitoring was also conducted for specific activities, including bridge and culvert removal, road construction, and timber harvesting. Associated with monitoring, a land systems inventory was developed and planned to correlate sediment yield with land type.

Four hundred acres of land have been revegetated to reduce erosion on mass wastage areas, small slumps, road cut/fill slopes, borrow areas and in harvest units. In addition, a special restoration project of an alluvial fan borrow area was initiated to reduce water quality impacts, including suspended sediment and turbidity.

Three studies are underway to determine the accelerated sedimentation rates due to forest roading and harvest, the surface erosion rates of mass wastage areas over time, and optimum vegetative mix and reestablishment techniques.

b. Ketchikan Area: Six monitoring stations were operated, two of which were in cooperation with the Geological Survey. In addition, several bridge sites have been monitored to evaluate channel stability. Three watersheds were intensively inventoried to correlate landform, soil and channel characteristics with suspended sediment concentration.

Plans were completed to restore 50 acres of abandoned roads, cut banks and stream banks. In addition, studies are underway with the State of Alaska, Department of Fish and Game to provide fish passage through culverts and log jams while maintaining channel stability.

c. Stikine Area: Four monitoring stations were operated, one of which was in cooperation with the Geological Survey. Several stream crossings were monitored to quantify accelerated sedimentation rates associated with construction and use. Similar monitoring was conducted

on a small watershed completely within a harvest unit. In conjunction with the monitoring activities, four sites have been sampled to determine sediment rating curves representative of different land and channel characteristics.

Seventy-six acres of forest lands were restored, including 15 acres of landslides. This included some maintenance of previously restored areas through refertilization.

Two studies were planned, one to determine the effects of disturbing and/or removing forest soil duff layers on regeneration of timber, and another study to evaluate water quality and fish habitat impacts of utilizing alluvial borrow sources.

Chugach National Forest. Eight monitoring station were operated, three of which were in cooperation with the Geological Survey.

ALASKA REGION

GEOLOGICAL SURVEY

Arctic Slope Subregion

1. The environmental impact study on the National Petroleum Reserve of Alaska was begun in June 1977. Suspended-sediment data are being collected at Meade River at Atkasuk, Alaska.

2. Suspended-sediment data are being collected on a periodic basis at the Kuparuk River near Deadhorse, Alaska, as part of NASQAN.

Northwest Alaska Subregion

1. Suspended-sediment data are being collected on a periodic basis at Kobuk River near Kiana, Alaska, as part of NASQAN.

Yukon Subregion

1. A cooperative study with U.S. Corps of Engineers to collect and evaluate sediment-transport and river hydraulic data in the Tanana River near Fairbanks, Alaska, was continued in 1978. Suspended-sediment and bedload data are being collected in the Tanana River at Fairbanks, Alaska, and at Tanana River near the North Pole, Alaska. The Corps of Engineers will use these data in the design and operation of engineering structures on the Tanana River and in regulating the quarrying of gravel from the river in the vicinity of Fairbanks, Alaska.

2. As part of the Alaska Coal Research Study, suspended-sediment data were collected on a periodic basis at the following sites:

Healy Creek at Suntrana, Alaska
Healy Creek near Usibelli, Alaska
Cripple Creek near Suntrana, Alaska
Coal Creek near Suntrana, Alaska
Lignite Creek above Sanderson Creek near Suntrana, Alaska
Lignite Creek below Sanderson Creek near Suntrana, Alaska
Lignite Creek near Healy, Alaska

Data collection on this project ended in 1978, and a report is in progress.

3. In cooperation with the Alaska Department of Natural Resources, a study was continued in 1978 to evaluate the geohydrology of the Delta-Clearwater area in relation to the agricultural development in this area. Suspended-sediment data were collected at Clearwater Creek near Delta Junction, Alaska.

4. Suspended-sediment data are being collected on a periodic basis at the Yukon River at Pilot Station, Alaska, as a part of NASQAN.

5. Suspended-sediment data were collected on an infrequent basis at Yukon River at Eagle, Alaska.

Southwest Subregion

1. Suspended-sediment data are being collected on a periodic basis at Kuskokwim River at Crooked Creek, Alaska, as a part of NASQAN.

South Central Alaska Region

1. The cooperative program with the U.S. Army Corps of Engineers to evaluate the proposed Watana and Devil's Canyon hydroelectric power sites was continued through 1978. Suspended-sediment data are being collected on a periodic basis at Susitna River near Denali, Alaska, and at Susitna River near Gold Creek, Alaska.

2. In cooperation with the Alaska Department of Fish and Game, suspended-sediment data are being collected on a periodic basis at Susitna River above Portage Creek near Gold Creek, Alaska, at Susitna River at Gold Creek, Alaska, and at Susitna River at Sunshine, Alaska.

3. As part of the Alaska Coal Research Study, suspended-sediment data are being collected at the following sites:

Bishop Creek near Tyonek, Alaska
Capps Creek near Tyonek, Alaska
Chuit Creek 5.4 miles above mouth near Tyonek, Alaska
Chuit Creek at mouth near Tyonek, Alaska
Chuitna River above Chuit Creek, near Tyonek, Alaska
Chuitna River below Wolverine, Creek, near Tyonek, Alaska
Chuitna River near Tyonek, Alaska
Peters Creek near Petersville, Alaska
Peters Creek above Martin Creek, at Peters Creek, Alaska

Data collection on this project ended in 1978, and a report is in process.

4. The cooperative program with the U.S. Forest Service was continued through 1978. Suspended-sediment data are being collected on a periodic basis at Dick Creek near Cordova, Alaska, and at West Fork Olsen Bay Creek near Cordova, Alaska. These data will be used to define the water quality on Forest Service lands.

5. Suspended-sediment data are being collected on a periodic basis at Talkeetna River near Talkeetna, Alaska, as part of the National Hydrologic Benchmark Network.

6. Suspended-sediment data are being collected on a periodic basis at Susitna River at Susitna Station, Alaska, and at Copper River near Chitina, Alaska, as a part of NASQAN.

7. Suspended-sediment data are being collected on a miscellaneous basis at the following sites:

Gulkana River near Sourdough, Alaska
Little Tonsina River near Tonsina, Alaska

8. A cooperative study with the New Capital Site Planning Commission to collect hydrologic data for the New Capital Site near Willow was initiated and terminated in 1978. Miscellaneous suspended-sediment samples were collected at the following sites:

Deception Creek above tributary, near Houston, Alaska
Deception Creek tributary near Houston, Alaska
Deception Creek near Willow, Alaska
Little Susitna River at Houston, Alaska
Willow Creek at Hatcher Pass Road, near Willow, Alaska
Willow Creek at Willow, Alaska

Southeast Alaska Subregion

1. As part of the cooperative program with the U.S. Forest Service, sediment data are being collected on a periodic basis at Kalinin Creek near Sitka, Alaska, at Old Tom Creek near Kasaan, Alaska, at Big Creek near Point Baker, Alaska, at Perkins Creek near Ketchikan, Alaska, and at Rocky Pass Creek near Kake, Alaska. These data will be used to define the water quality of U.S. Forest Service lands.

2. A cooperative study with the Alaska Department of Environmental Conservation on the Hydrology and Water Quality of the Keta River basin near Ketchikan was continued in 1978. Suspended-sediment data are being collected at Keta River near Ketchikan, Alaska, and at White Creek near Ketchikan, Alaska.

3. Suspended-sediment data are being collected on a periodic basis at the Stikine River near Wrangell, Alaska, and at Skagway River at Skagway, Alaska, as a part of NASQAN.

4. Suspended-sediment data are being collected on a miscellaneous basis at Whipple Creek near Ward Cove, Alaska.

Special Studies

Trans-Alaska Pipeline System

Channel erosion surveys were discontinued at 28 sites along the Trans-Alaska Pipeline System (TAPS) at most major stream crossings. This work had continued a surveillance project begun in 1971 before construction, and continued through construction and early operation of TAPS.

For additional information about Geological Survey activities within this region, contact the following office:

District Chief, WRD
U.S. Geological Survey
Skyline Building
218 East Street
Anchorage, AK 99501

HAWAII REGION

GEOLOGICAL SURVEY

Hawaii Subregion

1. Suspended-sediment data are being collected on a monthly basis at Wailuku River at Piihonua, Hawaii, as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at Honolii Stream near Papaikou, Hawaii, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a daily basis at one site in the Wailuku River basin, Hawaii, in cooperation with the U.S. Corps of Engineers. An automatic sampler was installed at the sampling site in Hilo.

Maui Subregion

1. Suspended-sediment data are being collected on a monthly basis at Kahakuloa Stream near Honokohau, Hawaii, as a part of NASQAN.

Molokai Subregion

1. Suspended-sediment data are being collected on a monthly basis at Halawa Stream near Halawa, Hawaii, as a part of NASQAN.

Oahu Subregion

1. Suspended-sediment data are being collected at the following sites:

   (a) Waikele and Kalihi Streams, Hawaii, as a part of NASQAN.

   (b) Kipapa and Kalihi forest reserves, Hawaii, in cooperation with the U.S. Forest Service.

   (c) Kamooalii Stream near Kaneohe, Hawaii, in cooperation with the U.S. Corps of Engineers.

   (d) Moanalua Valley in cooperation with the State of Hawaii, Department of Land and Natural Resources.

Kauai Subregion

1. Suspended-sediment data are being collected on a monthly basis at Waimea River at Waimea, Hawaii, as a part of NASQAN.

For additional information about Geological Survey activities within this region, contact the following office:

District Chief, WRD
U.S. Geological Survey
P.O. Box 50166
300 Ala Moana Boulevard, Room 6610
Honolulu, HI 96850

CARIBBEAN REGION

FOREST SERVICE

Caribbean National Forest in Puerto Rico. Seven acres of critical eroding lands were rehabilitated resulting in annual sediment reduction of over 300 tons.

GEOLOGICAL SURVEY

Puerto Rico Subregion

1. Suspended-sediment data are being collected on a monthly basis at 54 sites in cooperation with the Puerto Rico Environmental Board.

2. Suspended-sediment data are being collected on a monthly basis at the following sites as a part of NASQAN:

Rio de la Plata at Toa Alta, P.R.
Rio Grande de Monati near Manati, P.R.
Rio Grande de Anasco near San Sabastian, P.R.
Rio Grande de Patilas near Patillas, P.R.
Rio Fajardo near Fajardo, P.R.
Rio Cerrillos near Ponce, P.R.

3. Suspended-sediment are being collected on a daily basis at Rio Tanama near Utuado, P.R. in cooperation with the Puerto Rico Environmental Quality Board.

4. Suspended-sediment are being collected on a daily basis at Rio Cerrillos near Ponce, P.R. in cooperation with the U.S. Corps of Engineers.

Special Studies

A preliminary report, done in cooperation with the Puerto Rico Environmental Quality Board, reports the results of seven reservoirs surveys made during 1977. This report has been submitted to the cooperator in 1978.

For additional information about Geological Survey activities within this region, contact the following office:

District Chief, WRD
U.S. Geological Survey
P.O. Box 34168, Building 652
Ft. Buchanan, PR 00934

FOREIGN ACTIVITIES

Bureau of Reclamation

Hydrologic design data for appraisal level designs of Batu and Gombak damsites for the Kuala Lumpur Flood Mitigation Project, Maylaysia were reviewed. Sediment deposition estimates of 1.85×10^6 m^3 (1500 acre-ft) for Batu Reservoir and 7.65×10^6 m^3 (6200 acre-ft) for Gombak Reservoir were approved.

A set of 28 color photographs illustrating sediment erosion and sampling procedures in the United States were sent to Mr. V. V. Romonovsky, the U.S.S.R. representative in the UNESCO IHP Working Group on Methods of Estimation of Man's Activities on Sedimentation Processes in River Basins. A Final revised version of Sections 0.1 Introduction, 2.0 Erosion and Sedimentation process (Sections 2.1 and 2.2), 3.0 The Prediction of Effects of Man's Activities (Sections 3.1 3.2, and 3.3), Appendix 1 List of Terms and Definitions, Appendix 3 Calculation Techniques for Interfluvial Areas, and 5.0 Case Study for Wet Tropical Area in Puerto Rico was completed and submitted to UNESCO Headquarters in Paris, France, and to other members of the Working Group on "Methods of Estimation of Man's Activities on Sedimentation Processes in River Basins."

A representative of the Sedimentation Section of the Bureau of Reclamation attended the U.S.-Japan Seminar in Honolulu, Hawaii, March 20-24, 1978. The seminar was partially funded by the National Science Foundation. Participants from the United States and Japan presented papers and discussed the many sediment-related problems in both countries. Our representative presented a paper entitled "Reservoir Sedimentation." He then observed the sedimentation activities of the Environmental Quality and Keck Laboratories at California Institute of Technology in Pasadena, California, on March 27 and 28, 1978.

A meeting was held with Maiano P. Leuterio and Associate, Philippine Engineers, concerning sediment sampling procedures, and conducted training and orientation in water use, ground water, and water quality.

Training for 3 weeks was provided for Engineers Ronald Salazar and Carlos Picado of Costa Rica in all aspects of reservoir sedimentation. Two weeks' office training was on techniques for computer and analyzing the data from reservoir surveys and on procedures for prediction of sediment distribution in a reservoir.

A representative of the Sedimentation Section of the Bureau of Reclamation traveled to Athens, Greece, to review the reservoir sedimentation aspects of Kria Vrissi Dam on the Pinios River in the Thessaly Plain. A review was made of the reservoir sediment inflow

values shown in the report by Electro-Watt Engineering Services, Ltd., of Zurich, Switzerland. The Electro-Watt report indicated an annual sediment yield of about 1400 m^3/km^2 (0.44 acre-ft/mi^2) for the 983 km^2 (380 mi^2) area above Kria Vrissi damsite. An estimated sediment inflow rate of 400 m^3/km^2 (0.13 acre-ft/mi^2) per year was derived by using additional data and Bureau of Reclamation procedures. A preliminary report describing field observations and presenting the supporting material for the revised sediment inflow values was given to the appropriate Greek officials before returning to Denver.

Feasibility Designs and Estimates were reviewed for San Isidro Dam on the Rio San Juan in Nicaragua. Data are needed which suport or can be used to modify the rating curve for Station Sabalos. Ranges must be surveyed below the damsite so that a tailwater study can be performed. A degradation estimate is needed which will require complete streamflow records as well as sieve analysis of bed materials. Total sediment inflow must be estimated for establishing storage requirements and design criteria for penstocks and outlet works.

A representative of the Sedimentation Section participated as the Bureau's representative on the tour of the Peoples Republic of China from September 25, to October 14, 1978. The group visited East China College of Hydraulic Engineering and Nanking Hydraulic Research Institute in Nanking where a technical session was held in river hydraulics, sediment transport, and reservoir sedimentation. A series of workshops on hydrology, hydraulics, and sedimentation were conducted for exchange of technical information at Chinghua University in Peking and with the Yellow River Committee in Honan Province in Chengchow. The highlight of the visit was the few days on the Yellow River with inpsection of the Mangshan Pumping Station, bank protection works, and the Sanmenhsia Dam. The Sanmenhsia Dam, the furthermost downstream dam on the Yellow River, was completed in 1960, but because of sediment deposition problems it was reconstructed by the Chinese, starting in 1965, with addition of tunnels and lower outlets for sluicing sediment.

The Water Supply Augmentation for the United Arab Emirates Draft Report was reviewed. Average annual sediment inflow to a retention weir on Wadi Ham was estimated to be 32 000 m^3 (26 acre-ft) or about 1.6×10^6 m^3 (1300 acre-ft) in 50 years. The recommended 50-year sediment volume for Wadi Bih Reservoir is 4.0×10^6 m^3 (3240 acre-ft).

LABORATORY AND OTHER RESEARCH ACTIVITIES

Bureau of Reclamation

A representative of the Bureau participated in an interagency workshop on sediment and nutrient impacts on the Colorado River Basin conducted by Dr. Edward G. Farnworth, Research Associate for an EPA-supported research project.

A Bureau representative attended the regular meeting of the Technical Subcommittee of the Federal Interagency Sedimentation Committee in Arcata, California. A field trip over the Redwood Creek drainage area and Redwood National Park highlighted the sediment sampling program under the direction of the Geological Survey in this timber area of high sediment yield.

A summary tabulation of all Bureau of Reclamation reservoirs in the State of Colorado was prepared and sent to a graduate student in the Department of Earth Science at Colorado State University. The only USBR reservoir which has been surveyed was Paonia Reservoir in 1969.

A program which plots cross sections from a PSEUDO data deck was modified to handle up to three data decks for the purpose of plotting overlay cross sections. The modified program was used to plot cross-section data from the Grand Coulee Tailwater area for the years 1967, 1975, and 1977, for comparison.

An inventory was prepared of all reservoirs surveyed by the Bureau to determine the appropriate sediment deposition design curves. The information was gathered as a part of the work in the Sedimentation Section of the ICOLD Committee on Sedimentation of Reservoirs. A summary table for those reservoirs fitting a Type II Design Curve was transmitted to Mr. B. N. Murthy, Director, Damodar Valley Corporation in India in reply to his request.

A representative of the Bureau participated in the "Workshop on Instream Flow Criteria and Modeling" at the Environmental Resources Center at Colorado State University, November 6-9, 1978. The workshop was sponsored jointly by the Office of Water Research and Technology and the Instream Flow Group of the U.S. Fish and Wildlife Service. The Bureau's participation was in the working group under Module A: River Mechanics, Morphology, and Watershed Management.

A 2-day seminar on Reservoir Sediment Surveys was held at the Southwest Regional Office in Amarillo, Texas. The seminar was attended by 32 Bureau personnel from the Southwest, Lower Colorado, Upper Colorado, Upper Missouri, and Mid-Pacific Regional Offices and several project offices.

A series of four lectures on "Water Related Sediment Problems" was presented to participants in the 1978 Water Systems Management Workshop held in Denver, Colorado, November 13-17, 1978.

A summary of the Bureau of Reclamation's sedimentation and erosion problems, along with a list of reference articles or reports on the subject, were submitted to Dr. H. W. Shen of Colorado State University for use in a report he is preparing for the American Geophysical Union.

Cross-section data which were used in a 1970 Red Bluff backwater study were prepared for use by the U.S. Corps of Engineers, Sacramento District, in developing a sediment model of the river from Bend Bridge to Hamilton City.

A 1:120 physical model study was made to help determine the effects of hydraulics on bank stability downstream of the Grand Coulee Third Powerplant extension, Columbia River, Washington. Tractive forces determined by velocity distributions measured in the model were scaled to prototype. Then relationships such as Lane's critical tractive curves or Shields' sediment entrainment function were used to predict sizes of sediment that can move on the river bottom and riverbanks.

A 1:36 scale model study of the Truth and Consequences, New Mexico, baffled spillway structure and the dry gulch area downstream was made for the Soil Conservation Service. The model was used to study local scour at the base of spillway for a design hydrograph and various constant discharges.

A full-scale sectional model of a filter bed is being used to study problems of keeping sediment 75 microns and greater from getting into Cordell Pumping Plant and irrigation system on the Okanogan River, Washington. Back flushing to remove sediment from coarser materials placed on top of the filter for river scour protection is also being studied.

A full-scale sectional model of a well and screen is being used to study well development and prevention of sediment travel through gravel packs into production water.

A full-scale sectional model is being used to study movement of sediment through gravel envelopes into agriculture drains.

CORPS OF ENGINEERS

Coastal Engineering Research Center

Littoral Transport Testing Procedures. The purpose of this work unit is to improve the understanding and operation of coastal engineering laboratory experiments and models.

CERC Miscellaneous Report No. 77-7, Volumes III through VII by C.B. Chesnutt and R.P. Stafford were published during 1977. Contents of these reports on movable-bed beach models were described in the 1977 Annual Report on Sedimentation.

Volume VIII, the final volume in the series, was published in 1978, and provides a comprehensive analysis of results from all ten experiments.

Variation in wave reflection from a movable bed as it adjusted to the impinging waves was the primary source of wave height variability in ten experiments in 6- and 10-foot-wide wave tanks. Re-reflection of waves from the wave generator, secondary waves, transverse waves, and cross waves also contributed to the wave height variability.

The reflection coefficient, K_R, variation ranged from 0.02 to 0.12 in one experiment to as much as from 0.04 to 0.27 in another experiment. Changes in the foreshore slope and berm-crest elevation, the breaker type, the slope and top elevation of the offshore slope, and the distance between the foreshore and offshore were the sources of the K_R variability. For a constant initial profile slope, the average K_R increased with increasing wave length; but for a constant wave length, the average K_R decreased with increasing initial profile slope. In nine experiments K_R tended to increase as the profile developed, indicating that the profile was reflecting, rather than absorbing, energy.

Profile equilibrium was not easily attained, particularly in five experiments with a wave steepness of 0.021, which is in the transition region between "winter" and "summer" waves. Experiments with winter or summer waves reached equilibrium more readily.

Laboratory effects, caused by differences in initial profile slope, initial test length (distance between the wave generator and the initial shoreline), tank width, and water temperature, affected the profile development and the wave height variability. Initial profile slope and initial test length should be kept constant to assure test repeatability in movable-bed experiments. The wave length-to-tank width ratio should be greater than or equal to three to assure two dimensionality of profile development, but two-dimensional profiles may not be realistic replications of three-dimensional profiles.

Wave-Sediment Interaction Studies in a Water Tunnel. In August 1978, CERC published TP 78-5 by Karl Lofquist of the National Bureau of Standards. The experimental results on sand ripple growth to equilibrium in sinusoidal flow permit improved prediction of offshore bed condition for given sediment and wave characteristics. In September 1978, Lofquist began a new CERC-sponsored study of wave energy loss with sand beds of various surface forms.

Limiting Water Depth to Sand Beach Erosion by Waves. A calculation procedure, previously published in CERC TP 77-9, was compared to extensive data, and was evaluated for effects of ignored variables. The favorable conclusions provide increased confidence for estimates of the seaward limit to the very active beach profile. Robert Hallermeier reported these conclusions at the 16th International Conference on Coastal Engineering in Hamburg, Germany, and the Conference Proceedings will include his paper "Uses for a Calculated Limit Depth to Beach Erosion."

Beach Profile Studies. The objectives of these studies are to observe the response of beaches to waves and tides of specific intensity and duration and to develop predictive techniques for estimating seasonal and storm-induced beach changes.

During the 1978 calendar year emphasis continued on the preparation of locality reports summarizing data collected since 1962.

The Westhampton Beach, NY, locality report was reviewed, revised, and submitted for CERC publication. This report is an analysis of beach profile survey data collected during the ten years following the March 1962 storm, and documents the short-term, seasonal, and long-term rates of beach changes and the effectiveness of a field of 15 impermeable groins.

A draft report entitled "Evaluation of Aerial Photographs to Determine Shoreline Changes" compares the accuracy of determining beach change rates using air photo analysis and standard surveying techniques. This report has been reviewed and is undergoing final revision for CERC publication.

A report summarizing bluff and shoreline changes in the vicinity of the Cook Nuclear Power Plant, on Lake Michigan is in preparation.

The following reports were published in CY 1978: "Beach and Nearshore Processes in Southeastern Florida," by DeWall (CERC R 78-4); "Spatial and Temporal Changes in New Jersey Beaches," by Everts and Czerniak (CERC R 78-9); and "Geometry of Profiles Across Inner-Continental Shelves of the Atlantic and Gulf Coasts of the United States," by Everts (CERC TP 78-4). Principal results of these reports have been identified in previous Annual Reports on Sedimentation.

A major effort has been continued in rewriting and combining existing computer programs used for editing, analyzing, and displaying beach profile survey data. The objective of the effort is to produce a package that will be usable on a number of different computer systems. A draft users' guide has been completed and technical paper on the package is in preparation.

Longshore Transport. Fifteen experiments relating wave conditions to longshore transport rate were completed in the Shore Processes Test Basin, at generator angles of 0, 10, 20 and 30 degrees. The measurements include hourly values of wave breaker angle, wave height, and longshore current, and four hourly values of transport rate. The data show considerable variability in all measured quantities that does not appear to have been reported in previous tests, probably because data were not previously measured so systematically. Initial results are similar to past laboratory tests. Experimental work is complete. The final report is being written.

Suspended Sediment - Field. Water samples were collected along CERC's research pier to measure suspended sediment concentrations. The work was done by the University of South Carolina under contract with CERC from 11 September to 17 September 1978. The final report is being written.

Effects of Long Term Great Lakes Water Level Changes. The purpose of this study is to develop a better understanding of the effects of the Great Lakes water level variations on bluff and shore erosion. One part of the study examined the lake shore and bluff changes which occurred at 17 profile lines located along the eastern shore of Lake Michigan between 1970 and 1974. Two contract reports discussing this part of the study have previously been published as CERC MP 10-75 and CERC TP 76-16.

The second part of the project is examining the effects of changing lake levels over relatively short stretches of lakeshore in Berrien County, Michigan. Through the use of semiannual air photographs taken between 1971 and 1974, bluff recession amounts and rates have been calculated every 30 m for 9 km of shore. Using these data it is possible to determine the effect of high lake levels, storms, and shore structures on the recession rate. Of particular interest are the effects of a 580 m long vertical sheet pile seawall which appears to have stabilized the bluff behind it while locally accelerating the erosion of the bluff adjacent to it. The increase in the amount of material eroded from the adjacent bluff appears to be related to the amount of material withheld from the sediment supply by the seawall. Average measured bluff recession was 3.66 m/yr with some sections experiencing losses of over 7.6 m/yr during the four year period. Results of this phase of the study are scheduled for publication in early 1979.

Storm Erosion Studies. The purpose of this study is to develop a method for predicting storm-induced beach changes. The first three years of study were devoted to collecting field data from various storms by attempting to survey a number of beaches just before and immediately following a storm. Study localities include Ludlam Island, NJ, Long Beach Island, NJ, and Dare County, NC (near CERC's North Carolina Field Research Facility). A total of 16 storms were monitored, varying in intensity from minor storms to Hurricane Belle on 9 August 1976.

The winter of 1977-1978 provided the best data of the study with three major northeast storms and five minor ones. The combined impact of these storms was a net amount of erosion at all the study beaches. Peak erosion occurred at Ludlam Island where an average of $38.5 m^3/m$ of beach were lost between October 1977 and March 1978.

Dramatic changes occurred during the major storms with frequent lowland flooding and extensive dune erosion. A paper discussing the best monitored storm, which occurred 19 December 1977, is published in the January 1979 issue of "Storm and Beach."

The primary factors affecting the amount of erosion during a storm are: the duration of strong onshore winds and high waves, coupled with the storm surge height, fetch length and the characteristics of the beach (width, elevation, sand size). In the final phase of the study, the data collected, combined with other available storm change data, will be analyzed in order to understand the relationships between these variables and to develop the predictive method.

General Investigation of Tidal Inlets. The report ("Hydraulics and Dynamics of North Inlet, South Carolina, 1975-76" by D. Nummedal and S.M. Humphries. GITI 16) was published during calendar year 1978. An abstract follows:

North Inlet, South Carolina, was selected as a natural tidal inlet for investigation within the scope of the Army Corps of Engineers' program on General Investigations of Tidal Inlets. Over a two-year period, from July 1974 to June 1976, eight two-week intensive field sessions were conducted at the inlet. Three tide gages provided nearly continuous water surface elevation records for the ocean and tidal creeks throughout the period of investigation.

The analysis presented in this report focuses on three attributes of the inlet environment: (a) the inlet hydraulics, (b) the longshore currents adjacent to the inlet, and (c) the seasonal morphologic change of the North Inlet tidal deltas and adjacent beaches.

North Inlet is hydraulically ebb dominated. For the throat section, the peak ebb velocity exceeded the peak flood by a factor of 1.22. The model presented to account for this difference explains the ebb dominance as a result of the different efficiency of water exchange between the ocean and the bay at high and low tide.

The longshore currents off Debidue Island were found to be significantly controlled by the wind stress. In a multiple stepwide regression procedure, the longshore component of wind velocity was found to explain more of the variance in the observed longshore current velocity than any other measured environmental parameter.

Topographic mapping of inlet shoals and adjacent beaches, combined with bathymetric profiling of the throat and the major channels, suggest that there is a sediment exchange between the channels and the beaches. During periods of fair weather, the beaches accrete and the channels appear to scour. During high-energy conditions, the reverse seems to occur.

In addition, work continued on five other reports, all scheduled for publication in calendar year 1979.

Data Collection of Littoral Materials and Forces (LEO). The Littoral Environment Observation (LEO) program is a cooperative program carried out among Corps of Engineers District Offices, CERC, representative state agencies and volunteer observers. The present program involves the States of California, Michigan, Texas, Florida, Maryland, Oregon, Ohio, Georgia, Wisconsin, Washington, North Carolina, South Carolina, Pennsylvania, Massachusetts and New York. In addition, LEO sites established under the Section 54 SEAP Program include the States of Washington, Alaska, Hawaii, Pennsylvania, California and Florida. The parameters measured daily are: breaker height, period, direction, type; longshore current velocities; wind speed and direction; foreshore slope; rip current spacing; beach cusp spacing and monthly sand samples.

Weekly profile measurements are made at the sites on the Great Lakes. The LEO data is collected, collated and summarized for participating Corps Districts, state agencies and other volunteers. These data summaries show the climatology of surf, nearshore currents, coastal winds, beach geometry and sediment characteristics.

Numerical Modeling of Coastal Systems. This study was initiated in 1976 to investigate the feasibility of developing a numerical model that would predict the response of a shoreline to changes in wave energy acting on it. Initial conclusions are that an approximate model suitable for use in planning studies can be developed that will provide estimates of the effects of various coastal structures on

adjacent shorelines. A detailed literature survey of publications relating to mathematical prediction of shoreline evolution was published in 1977. (MR 77-10, "Mathematical Modeling of Shoreline Evolution," by B. LeMehaute and M. Soldate).

Current efforts are being directed toward the development of a numerical computer model based on the equations of longshore sediment transport and the mass balance equation for the sediment. A report describing the mathematical model will be published in 1979. The eventual product will be a computer program that will permit pre-construction estimates of the effects of proposed coastal structures, the interaction among several coastal structures along a shoreline and a method of estimating the damages attributable to the construction of a given navigation project.

Sedimentation in High Tide Range Areas. Objectives of this study are to develop methods to predict the degree of shoaling that might be expected in a prototype harbor basin in Alaskan waters or other high tide range areas, and to develop a means of minimizing shoaling. Emphasis in 1978 was on data analysis and reporting. Two reports were begun or continued:

1. "Sedimentation Rate Prediction for Certain Inclosed Harbors Under Ice-Free Conditions," with publication anticipated as a CERC Coastal Engineering Technical Aid.

2. "Sedimentation Rate Prediction for Certain Inclosed Harbors During Periods of Ice Cover," with anticipated publication as a CERC Coastal Engineering Technical Aid (CETA).

The study will be completed and terminated with the scheduled publication of the two reports in 1979.

Weir Jetty Orientation and Evaluation. A three phase study to investigate the functional and hydraulic behavior of weir jetty systems was initiated in late 1976. The research study includes two sets of laboratory experiments and a prototype data collection program.

A series of movable-bed laboratory tests will seek to quantify the distribution of sediment transport across a weir section for various wave conditions. A second series of tests using tracer material in a fixed bed model will attempt to determine relative volumes of sediment carried over the weir section and around the jetty and monitor the response of the updrift shoreline of a number of weir jetty systems to changes in wave direction. The prototype data collection program will measure the distribution of sediment transported across the weir sections of currently existing systems.

Expected output from this study will permit designers to use the empirical data to evaluate proposed weir jetty system designs and to establish OPTIMUM weir crest elevation, orientation and length.

Evaluation of Shore Protection Structures. Analysis on the Data from the North Carolina Beaches and the Texas Coast Inlet Study is currently in progress, the former under contract and the latter in house. Two reports, a CETA relating sea-level rise to erosion rates and the final draft of, "Current Status of Guidelines for the Design of Weir Jetty Systems" are under preparation. Monitoring programs have been initiated at both Lakeview Park, Ohio (Breakwaters) and Murrells Inlet, SC (Weir Jetty System), and also, a monitoring program is being developed for Little River Inlet, SC.

Channel Islands Longshore Transport Study. This study was initiated to determine the empirical coefficient relating longshore energy flux with longshore sediment transport. Hydrographic and topographic surveys were taken at intervals ranging from 20 to 45 days and wave data collected on a regular basis. Both wave gage data and visual surf observations were obtained. The data collection phase of the project has been completed and data analysis is underway. A preliminary report on project results was made at the 15th International Conference on Coastal Engineering, "Longshore Transport at Total Littoral Barrier," by R.O. Bruno and C.G. Gable. These results indicate that transport rates may be larger than is currently believed for a given flux level; however, conclusions must await the completion of a more detailed data analysis. A report on the shore response to the breakwater titled, "Sediments Impounded by and Offshore Breakwater," by R.O. Bruno, G.M. Watts and C.G. Gable was presented at Sediments '77' ASCE Specialty Conference.

CURRITUCK Sand Bypass Test. The split-hull dredge CURRITUCK has the capability to excavate sediment from shallow coastal inlet entrance channels and transfer that sediment to shallow nearshore areas adjacent to the inlets. The purposes of the CURRITUCK study are to monitor the movement of dredged material placed in the nearshore zone; to determine its response to littoral processes; and to evaluate the shallow water placement technique for beach restoration application.

Phase I of the study was a 1976 field effort to monitor the movement of 35,000 yd^3 (27,000 m^3) of sand placed as a single mound in minimum water depths of eight feet near New River Inlet, NC. The major finding was that most of the sand moved rapidly landward into the surf zone. The success was incomplete, though, in that most of the dumped sand, once it reached the surf zone, was carried in an alongshore direction rather than onshore to restore the adjacent beach. The net volume of sand in the total littoral system, however, was increased.

Following completion of Phase I, a Phase II field operation was initiated at the same field site during the summer of 1978 to examine the movement of sand placed in several mounds at different water depths. If a timely shoreward movement of sand continued to result with the deeper water placement technique, the cost efficiency of the disposal operation could be significantly increased.

The first six-month phase of the twelve-month Phase II field study was conducted during the summer and fall of 1978. A total of 53,000 yd^3 of sand was placed as three separate mounds in water depths of 8 ft, 10 ft, and 12 ft. Time-sequence profile data (CRAB surveys), sediment samples and wave and current data were collected. A preliminary examination of the six-month data set indicates that the shallowest mound responded similarly to that of Phase I. Although sand movement occurred on the deeper-water mounds, the transport effects were much less. Analysis of data from the planned twelve-month field effort is necessary to isolate seasonal effects.

An initial report on Phase I was published in 1977 ASCE Sediment '77', "Nearshore Disposal: Onshore Sediment Transport," by R.K. Schwartz and F.R. Musialowski) and a more extensive final report is being published by CERC. An interim report on Phase IV is planned for May 1979.

Prototype Experimental Groin, Point Mugu, California. The experimental and data collection phase of the study was completed 30 June 1976. All components of the permeable groin were removed by January 1977. The study is currently in the data analysis phase.

The final hydrographic survey and sediment samples were obtained in May 1976. Approximately 500 sand samples have been analyzed to determine mean particle size distribution and other statistical parameters. These parameters are being studied to determine their relationship to the longshore energy transport, foreshore beach slope and beach firmness.

This information will be included in the report on the functional performance of the experimental groing due to be published in 1979.

Coastal Sediments. Analysis and interpretation of geophysical data and sediment cores from coastal waters of the Atlantic, Pacific, Gulf, and Great Lakes coasts continued during 1978. Personnel working on projects under this work unit were also engaged in Phase II of a cooperative effort with the Ohio Geological Survey to collect sediment data from southern Lake Erie for the purpose of assessing the offshore sand resources available for beach restoration and nourishment. An additional data collection survey was also undertaken in Lake Erie off Erie, Pennsylvania, as a reimbursable project for the Buffalo District.

The report on sand resources in Pennsylvania waters of Lake Erie, together with a report on a reimbursable project of a similar nature off Galveston, Texas, prepared in 1978, were judged to be of interest to the scientific and engineering community; consequently, these reports were slightly revised and prepared for publication by CERC under this work unit. Publication of both reports is scheduled for 1979.

The first draft of a sand resources report covering the inner continental shelf off New Jersey was completed during the year and publication is scheduled for 1979. Work on a similar report covering the Little Egg Harbor area of New Jersey was initated late in 1978.

Final draft of a sand resource report for eastern Lake Michigan was completed in 1978 and is under review in the CERC Publications Branch. Draft copies were furnished by request to the Michigan Department of Natural Resources to aid them in planning additional offshore mineral resources studies.

Work was initiated on a CETA designed to outline the procedures for setting up and conducting offshore sand resources surveys of specific areas for project planning purpose. This guidance should be useful for District personnel engaged in coastal projects.

Work was also initiated on a study of the importance of offshore sand sources to the natural shore and nearshore sediment budget. The initial effort consists of literature review and assessment of data collected to date under CERC projects to provide a base of further study.

Beach Fill Sediment Criteria.

1. Guidelines for the Design of Beach Fills. A CETA titled "Meaning and Use of the Phi Grade Scale" was prepared by R.D. Hobson to help engineers classify and analyze sediment texture for evaluating the suitability of potential beach fill sediments. This CETA supplements the existing guidance for predicting borrow material stability as contained in CERC TM 60 by W.R. James and CERC TP 77-6 by R.D. Hobson. Additional CETA's are planned that will outline procedures for sampling native beach and potential borrow sediments.

2. Monitoring Beach Fill Performance. Field monitoring studies were continued at Imperial Beach, CA, to obtain textural and volumetric data for testing, and possibly improving, the mathematical nourishment models proposed in CERC TM 60. Data collection for this three year study will be completed in 1979. A one-year old monitoring study at Rockaway Beach, NY, will be discontinued in favor of an alternate field site because erosion caused by extreme winter storms

in 1978 necessitated the placement of emergency beach fills. The alternate site will probably be located either in Florida or California. A third monitoring site will also be selected.

3. Evaluation of Potential Nearshore Borrow Sources. Offshore sand bodies may become an important future source for beach fill sediment. Ebb tidal delta complexes are commonly found along the East Coast and one such delta at New River, NC, was core sampled and surveyed to generally assess its fill potential. Results of this study, and from additional studies to be carried out at other "typical" sand bodies, will provide a basis for generally evaluating the fill potential of these kinds of sand resources.

4. Handling Loss Experiments. Three experiments were conducted in North Carolina and New York to evaluate modifications to sediment texture caused by dredging and handling operations. Results from these experiments reported by R.D. Hobson at three engineering conferences were that winnowing losses generally improved the predicted performance of dredged sediments as beach fill, and that a mathematical model shows promise which estimates potential handling losses by comparing textural attributes of sedimentary materials.

5. Other Ongoing Studies. Core sampling studies across the active profile are providing the depth component of beach sediment textural variability for use in improving beach sampling guidelines. Also, the analysis of sediments core-sampled from a sand trap feature at Channel Islands, CA, will provide data to estimate the winnowing function of the renourishment beach fill model, to document the textural filling history of the sand trap, and will serve as a basis for evaluating the relative merits of core sampling versus surface sampling of nearshore sediments.

Evaluation and Testing of Profile Response Model Great Lakes Shore Evolution. Long-term changes in the water elevation on the Great Lakes are cyclic, but unpredictable. As the weather varies, periods of increasing lake levels lasting for several years are followed by several years of falling levels; the cycle repeats itself. After reaching a 115-year record low in 1964, the annual mean surface elevation of Lake Michigan rose steadily to an 86-year record high in 1973. Beach profile sites initially established by the Lake Survey (USCEC) in 1967 on the east shore of Lake Michigan in the vicinity of Pentwater, Michigan, were resurveyed in 1969, 1971, 1975, and 1976. The purpose of the survey program was to gain insight into beach changes which accompany the lake level changes.

Comparison of short-term profile changes (days to months) with the net change over a number of years, indicated that storm and seasonal effects were overshadowed by a gradual, cumulative adjustment of the shore to the longer term increase in lake levels. Between 1967 and 1971 the annual mean elevation of Lake Michigan rose 0.5 meters. In

the restricted area where profiles dated back in 1967, most of the inner three longshore bars also rose 0.5 meters in elevation and migrated 26 meters landward. The shoreline retreated an average of only 13 meters during this period. Roughly one-half of this retreat was attributable to simple submergency as the lake rose; the other half represented recess due to actual erosion. A report summarizing bar characteristics and profile changes between 1967 and 1971 was published, (TR 76-1), "Observations of Barred Coastal Profiles Under the Influence of Rising Water Levels, Eastern Lake Michigan, 1967-71," by E.B. Hands.

In a cooperative program with NOAA the profile sites were resurveyed in 1975. Results showed that the rate of shore retreat remained well above this historic average even though the water level had reached its peak two years earlier. A presentation on the effect of submergence on shore erosion rates was made before the Second International Symposium on Land Subsidence, December 1976. ("Some Data Points on Erosion and Flooding for Subsiding Coastal Regions," by E.B. Hands).

The study area was resurveyed in 1976 to test, among other things, if recession was still continuing. At most stations the recession has slowed and some accretion had isolated the formerly receding dune face from continued wave erosion. The net erosion measured over the three years since the water levels peaked had caused the shore to recede to a position in good agreement with that which had been predicted in CERC TR 76-1 as necessary to bring the profile back into equilibrium. A presentation on the impact of coastal subsidence was made at the ASCE Sediments Symposium (November 1977) based on the 1967 to 1975 profile measurements together with data on changes in historic shoreline position elsewhere around Lake Michigan. ("Implications of Submergence for Coastal Engineers," E.B. Hands).

In 1978, two CERC reprints (78-7 and 78-11) based on this work unit were distributed. A report summarizing the shore changes from 1967 to 1976 and recommending a method for estimating the ultimate shore retreat under similar situations was prepared for CERC publication. A final report integrating shore and offshore changes will attempt to generalize the relationship between water level changes and shore erosion rates by balancing inshore erosion and offshore deposition. Preparation of this final report got underway in 1978.

CORPS OF ENGINEERS

The Hydrologic Engineering Center

The Corps of Engineers Hydrologic Engineering Center (HEC) continued to develop and apply mathematical models of sediment transport and river mechanics in 1978. The work focused on the generalized computer program "HEC-6, Scour and Deposition in Rivers and Reservoirs." Assistance was provided to the Sacramento District in application of a network version of HEC-6 to Cottonwood Creek in Northern California. Of particular importance to this study was the simulation of movement of spawning gravels. Improvement of the calculation of transport capacities for gravel size material in HEC-6 was accomplished as part of this study. HEC also assisted the St. Louis District in a study of sedimentation problems in Harding Ditch. HEC-6 is being used in this study to predict the response of a flood control channel to increased urbanization in the watershed.

The HEC continued to coordinate with the Sacramento District to develop theories and models of bank erosion processes. This effort will provide engineers with techniques for predicting the response of a river to local bank protection works.

A preliminary document entitled "Guidelines for Calibration and Application of HEC-6" was prepared.

CORPS OF ENGINEERS

Waterways Experiment Station

Title of Study:

Section 32 Program, Streambank Erosion Control (The Streambank Erosion Control and Demonstration Act of 1974-Public Law 93-251, Section 32, as amended by Public Law 94-587, Sections 155 and 161).

Conducted by:

U.S. Army Engineers Waterways Experiment Station

Conducted for:

Office, Chief of Engineers

Summary of Accomplishments:

The legislatively specified objectives of the "Section 32 Program" consist of (1) an evaluation of the extent of streambank erosion on navigable rivers and their tributaries; (2) development of new methods and techniques for bank protection, research on soil stability, and identification of the causes of erosion; (3) a report to the Congress on the results of such studies and the recommendations of the Secretary of the Army on means for the prevention and correction of streambank erosion; and (4) demonstration projects, including bank protection works.

During calendar year 1978 three flumes have been used to conduct channel flow tests, wave tests and innovative protection tests. Model tests on several streambank protection types have been accomplished and published in four brief research reports. Nine field inspections of existing bank protection were made and results of five were published and distributed to OCE, Divisions, and Districts.

Index properties, soil and river water chemistry, swell, and dielectric dispersion tests have been conducted on a geographical distribution of soil and river water samples. Flume tests have been completed on undisturbed and remolded soil samples. Rotating cylinder tests have been completed on remolded saturated soil samples.

Approximately 25 streambank erosion sites have been visited, resulting in the identification of the significant mechanisms and causes of bank erosion. Waterborne geophysical studies have been conducted on the Mississippi, White, Ohio, and Missouri Rivers. Model tests of two metal panels and seven membranes were made in a WES hydraulic flume.

Five spray-on soil surface stabilizers were tested at WES on loess slopes with and without grass seed as a potential protective system for upper bank stabilization.

An interim report of results to date was submitted to Congress.

Hydraulic research will be continued to evaluate the effectiveness of various streambank protection methods and materials to withstand wave attack, flow, rapid drawdown, and navigation effects. Field inspection and monitoring of demonstration sites of streambank protection will be continued and reported.

Laboratory test equipment will be designed, constructed, and calibrated to determine the erosion rate versus hydraulic shear stress for natural soil. Work will continue on developing a procedure for streambank stability analysis and a method to predict the critical shear stress at which erosion was initiated. Site-specific erosion problems will be related to details of fluvial geology on a regional basis and guidelines will be developed to aid in recognition of future erosion.

Title of Study:

Definition of Cause of Navigation Channel Shoaling

Conducted by:

U.S. Army Engineer Waterways Experiment Station

Conducted for:

Office, Chief of Engineers

Summary of Accomplishments:

The Definition of Cause of Navigation Channel Shoaling study was a portion of the Improvement of Operations and Maintenance Techniques (IOMT) program during FY 78 and has been transferred to the Coastal Engineering program for FY 79. It is funded by the Office, Chief of Engineers.

The objective of this research is to develop a coherent approach for the solution of estuarine navigation channel shoaling problems. This will be accomplished by classifying estuarine shoaling problems and showing how these problems should be solved, detailing step-by-step procedures. Areas requiring further research will be identified. Thus far, the major area of investigation has been literature surveys to isolate available information on the processes causing significant shoaling in navigation channels and ongoing research. A detailed review of pertinent literature on 43 Corps projects was also initiated to determine characteristics and magnitude of dredging at these sites. The following have been defined as subtasks of this study:

1. Evaluation and extent of shoaling problem--nationwide.

2. Survey and evaluation of shoaling volume determination.

3. Hydraulic research on causes of navigation shoaling.

4. Research on prediction of sediment transport, deposition, erosion, and resuspension.

5. Research on techniques to reduce shoaling cost.

6. Data management.

The objective of each of these subtasks has been formulated. Information derived from these subtasks would be used to generate an instructional report which would describe how to approach and solve navigation channel sedimentation problems. Thus, during our first year, we have assembled the available information in a manner which will eventually allow it to be applied to reduce maintenance dredging.

In the future, a report describing the state of knowledge of shoaling processes for the six study subtasks will be prepared. A research plan addressing needs identified in the report will be formulated. A report will be published describing how to approach and solve navigation channel sedimentation problems using existing field data. Results will be used to revise EM 1110-2-1607, Tidal Hydraulics, and contribute to a new EM on Channel Design.

Title of Study:

Effect of Depth and Width on Dredging Frequency

Conducted by:

U.S. Army Engineer Waterways Experiment Station

Conducted for:

Office, Chief of Engineers

Summary of Accomplishments:

The Effect of Depth and Width on Dredging Frequency study is a portion of the Improvement of Operations and Maintenance Techniques (IOMT) program, funded by the Office, Chief of Engineers. The objective of the project is to evaluate the effectiveness of advance maintenance dredging in reducing frequency and costs in coastal and inland channel and harbor maintenance and to establish guidelines necessary for governing this practice. Thus far, the major area of investigation has been literature and Corps of Engineers' districts surveys and the evaluation of advance maintenance dredging projects. An empirical technique based on historical dredging records has been developed to predict the effect of depth and width on dredging frequency and volume.

Accomplishments during Calendar Year 1978 include the following:

1. A literature survey to establish the state-of-the-art has been conducted. The Corps district survey to determine current advance maintenance criteria and identify all previous and current advance maintenance projects has been completed. A final report presenting these results has been published, "Effects of Depth on Dredging Frequency, Report 1" (TR H-78-5).

2. A report (Report 2) describing the methods now being used to predict the effect of deepened conditions on shoaling in a dredged navigation channel and presenting a rational, empirical approach to the problem based on historical dredging and shoaling data is in draft form.

3. Preliminary evaluation of historical dredging data from specific sites in the Galveston, New Orleans, Norfolk, Charleston, Baltimore, Philadelphia, Portland, Savannah, and Wilmington Districts has been conducted. Additional sites in these and other districts are currently being evaluated. Preparation of a draft report has begun.

4. A study to attempt to classify several projects according to how they have behaved historically with deepening is underway.

Future work will include continued evaluation of existing advance maintenance dredging projects. The final objective of the study is to publish a series of technical reports which (1) describe current advance maintenance criteria and identify previous and current projects; (2) describe an empirical technique, based on historical dredging records, to predict the effect of depth and width on dredging frequency and volume; (3) evaluate the shoaling results from existing advance maintenance projects; and (4) classify Corps' dredging projects with regard to advance maintenance effectiveness.

Title of Study:

Eductor Systems for Sandtrap Bypassing

Conducted by:

U.S. Army Engineer Waterways Experiment Station

Conducted for:

Office, Chief of Engineers

Summary of Accomplishments:

The purpose of this study is to develop effective systems for bypassing sand at tidal inlets and other obstructions to littoral transport, including dredged channels, jetties with and without weir sections and deposition basins, and breakwaters. Laboratory and field tests are required for development and evaluation of equipment and operating techniques.

Field tests of the experimental system at Santa Cruz Harbor, CA, were completed in March 1978. Those tests showed that jet pumps, when deployed on floating, flexible lines, are vulnerable to wave action and should not be used where short-period wave heights exceed about three feet. However, fixed-in-place jet pumps are extremely immune to wave attack and are capable of functioning effectively in storm-wave conditions. The system at Santa Cruz Harbor operated in breaking waves estimated to be 15 feet in height.

Field tests of ancillary equipment for fluidizing bottom sands were performed at Mexico Beach, FL. The field tests were inconclusive and a short series of laboratory experiments is planned for this equipment.

Revisions to the laboratory test facility were completed in CY 78, including installation of a new liner.

Report preparation was underway at the end of CY 78. An instruction manual to assist COE districts in planning bypassing projects using eductor systems will be completed in CY 79.

Title of Study:

Offshore Dredging Systems

Conducted by:

U.S. Army Engineer Waterways Experiment Station

Conducted for:

Office, Chief of Engineers

Summary of Accomplishments:

The Offshore Dredging Systems project is a portion of the Improvement of Operations and Maintenance Techniques (IOMT) program, funded by the Office, Chief of Engineers. The objective of the project is to develop new techniques, procedures, and equipment that will open new supply sources of beach nourishment materials and permit economic exploitation of these resources with a minimum disturbance of ecosystems.

Accomplishments during Calendar Year 1978 include the following:

1. Compilation and analysis of information gained from contract work which describes beach erosion projects in the continental U.S.

2. Completion of a technical report by CERC which includes detailed physical descriptions of example nourishment projects.

3. Draft report by WES of detailed wave descriptions of example nourishment projects.

Future efforts will be directed toward the selection and engineering development of nourishment systems suitable for the example projects thus defined.

Title of Study:

Predictive Models of Sediment Movement

Conducted by:

U.S. Army Engineer Waterways Experiment Station

Conducted for:

Office, Chief of Engineers

Summary of Accomplishments:

This is a portion of the Environmental and Water Quality Operational Studies (EWQOS) program. The objective is to develop state-of-the-art techniques into analytical techniques which can predict the rate of movement of sediment and the interaction between flow hydraulics and bed sediments.

The computer program "Scour and Deposition in Rivers and Reservoirs" (HEC-6) has been developed jointly with cooperative projects and funding under water quality research.

Accomplishments during CY 78:

1. Completion of Guidelines for using the program "Scour and Deposition in Rivers and Reservoirs," HEC-6.

2. Completion of the new Stream-Network Version of HEC-6 led to a new library version for testing prior to release.

3. Testing the Einstein Bed-Load Function revealed additional development of a bed roughness predictor must precede release of that capability in a library version of HEC-6.

4. The addition of modified silt-clay functions for erosion required substantial changes to the input data structure for a general library version and, consequently, these were not included in the new library deck.

Future work will include development of the HEC-6 one-dimensional model as well as the development of criteria for forecasting the development of reservoir deltas and the behavior of fines in the reservoir.

Title of Study:

Dredged Material Containment Areas

Conducted by:

U.S. Army Engineer Waterways Experiment Station

Conducted for:

Office, Chief of Engineers

Summary of Accomplishments:

Four field sites were investigated to provide field and laboratory data for the development of a methodology for design of fine-grained dredged material containment areas. Samples of sediments were taken from the channel and harbor sediments to be dredged and used in laboratory testing.

A grab-type sampler was used for sampling and a sufficient number of samples were taken over the dredging reaches to ensure that the samples were representative of the material to be dredged and placed in the containment areas. Most of the samples were taken from maintenance dredging projects.

Extensive laboratory investigations were performed to characterize the physical and settling properties of the sediments. Laboratory tests included grain-size determinations, plasticity analyses, organic content, specific gravity and column settling and sedimentation tests. All samples were classified using the Unified Soils Classification System. In situ moisture contents were determined and used to compute in situ void ratios. A representative value from in situ void ratios was used in the design methodology to estimate volume required for the dredged material containment area.

The information obtained in these sedimentation activities was used to develop two design methods for designing dredged material containment areas, one for a saltwater dredging environment and one for a freshwater dredging environment. Design procedures were developed that provided sound theoretical approaches so that practicable dredged material containment areas could be designed.

The following reports are listed for further information:

Montgomery, R.L., "Methodology for Design of Fine-Grained Dredged Material Containment Areas," Technical Report D-78-56, 1979, U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, MS.

Palermo, M.R., Montgomery, R.L., Poindexter, M.E., "Guidelines for Designing, Operating and Managing Dredged Material Containment Areas," Technical Report DS-78-10, 1979, U.S. Army Engineer Waterways Experiment Station, CE, Vicksburg, MS.

Title of Study:

Characterization Study of Mississippi River Sediment

Conducted by:

U.S. Army Engineer Waterways Experiment Station

Conducted for:

New Orleans District, LMVD

Summary of Accomplishments:

An office investigation is in progress to characterize the suspended-sediment regime and bed-material composition of the Mississippi River. This effort is being completed under the auspices of Study Area IV, Sedimentation, Mississippi River Basin, of the Lower Mississippi Valley Division P-1 Potomology Program. Narratives are being prepared for each of the major sub-basins of the Mississippi River Basin describing their environmental characteristics, the cultural impacts of their suspended-sediment regime, the history of suspended-sediment sample collection in the sub-basin, and long-term trends in the sediment regime; in addition information will be provided in each narrative regarding natural and cultural impacts on the bed-material gradation.

CORPS OF ENGINEERS

Federal Inter-Agency Sedimentation Project
St. Anthony Falls Hydraulic Laboratory
University of Minnesota
Minneapolis, Minnesota

Annual project report for Calendar Year 1978 is described below.

Laboratory Research, Work in Progress. Through the combined efforts of personnel from the St. Anthony Falls Hydraulic Laboratory and the Sedimentation Project, construction of the bedload calibration facility was completed this year. A large indoor-flume was modified for testing full-size bedload samplers. The recirculating portion of the facility will pump sediment particles with diameters between 2mm and 64mm and will transport a maximum of 45 lb/sec. For the first series of test, 200 tons of gravel were sieved and loaded into the nine-foot wide channel. Six different styles of the Helley-Smith bedload sampler were tested at five different flow conditions. For each condition, each sampler was used to collect 120 individual samples. With the gravel (D_{50} = 6.5mm) dunes comprised the dominant bed-form for each flow condition. Data collected on the temporal and spatial variation in transport rate verified the need for intensive sampling when mean rates must be measured precisely. Next year, tests will be conducted with sediment in the sand-size range.

John Skinner, the project leader, continues to serve as chairman of an ASTM task group with the responsibility of preparing recommended procedures for collection of discharge-weighted suspended-sediment samples.

Production of the D-77, a new depth-integrating suspended-sediment sampler, was started this year. The D-77 sampler holds a three-liter plastic container equipped with a threaded sampling cap and nozzle. The sampler is 27 inches long and 8 1/2 inches in diameter. Cast in aluminum, the sampler weighs 27 pounds; cast in bronze, it weighs 65 pounds. A total of twenty-six samplers are being manufactured for field testing.

When sampling for suspended-sediment, errors will be caused by brass nozzles that are bent or burred. Because the damage may go undetected, the project has substituted plastic for brass. The new nozzles will not bend or burr. If broken, the damage is obvious and replacement can be made. If chemical tests are favorable, the nozzles will be color coded to particular types of samplers.

A single-stage sampler made of PVC has been designed to minimize contamination of sample by metals. This sampler is designed to collect automatically one sample from a predetermined point in an ephemeral stream. A filament of stream water flows through a special container until a trip mechanism is activated to isolate and seal the sample. The mechanism can be set to activate on either a rising stage or a falling stage when flow over the sampler intake is eight inches. The sampling point must be more than 18 inches above the streambed. Complete mechanical operation elimates the need for batteries and their attendant servicing.

To facilitate sampling of gravel, the project is designing a new piston-type bed-material sampler. To assist with cutting and retaining a core of noncohesive material, the barrel is fitted with a manually operated auger. The sample is removed from the barrel by pushing the auger out of the barrel. Development and testing will be continued in 1979.

Equipment Supply - Supply, repair, and calibration of a variety of sediment samplers and analyzers was continued. A catalog and detailed equipment manuals are available upon request. During 1978, sales and inventory were as follows:

	Instrument	Sold since 1940	Sold during 1978	Inventory, December 1978
US D-49	Sampler, depth-integrating	900	1	0
US D-74	Sampler, depth-integrating	198	74	2
US D-74AL	Sampler, depth-integrating	101	16	3
US DH-48	Hand Sampler	2557	144	47
US DH-59	Hand-line sediment sampler	992	50	3
US DH-75P	Hand Sampler	92	30	11
US DH-75Q	Hand Sampler	89	35	4
US DH-76	Hand-line sediment sampler	105	39	0
US P-61	Sampler, point-integrating	205	22	2
US P-63	Sampler, point-integrating	37	4	1
US P-72	Sampler, point-integrating	24	6	2
US BM-54	Bed-material sampler	173	8	2
US BMH-53	Bed-material sampler	283	14	4
US BMH-60	Bed-material sampler	198	17	2
US-SA	Particle-size analyzer	83	3	0
PS-67	Pumping sampler	42	0	0
PS-69	Pumping sampler	298	49	16
PS-C76	Chickasha pumping sampler	16	4	4
SS-72	Sample splitter	32	2	2
BP-76	Power supply	89	24	5

FEDERAL HIGHWAY ADMINISTRATION

The Federal Highway Administration (FHWA) concentrated its activities on four major areas: control of culvert outlet erosion, control of local scour around bridge piers, control of sediment produced by highway construction and control of highway water quality. Its major efforts were carried out by staff and contract research, and by the various studies in the Highway Planning and Research Program (HPR) and in the National Cooperative Highway Research Program (NCHRP).

Control of Culvert Outlet Erosion - The objectives of these studies are to investigate the various flow conditions and the forces involved at the outlet area, the material necessary to resist the erosion, and the special designs of energy dissipators and stilling basins to control the erosion.

A. Sponsored by FHWA, the U.S. Geological Survey Hydroscience Center at Bay St. Louis, Mississippi is conducting energy dissipator study entitled "Investigation of Rigid Boundary Basins in Flared Outlets from Circular Culverts." This study will yield basin drag coefficients for serrated roughness elements in flared transition sections at culvert outlets. Testing for circular culverts were completed during C.Y. 1978 and the basin has been modified to conduct selective tests with a square culvert.

B. The University of Akron continued the study, sponsored under the HPR program by the Ohio Department of Transportation (ODOT), on Field and Laboratory Evaluation of Energy Dissipators for Culvert and Storm Drain Outlets. This study is directed toward two dissipator concepts that can be precast for culvert installation that do not require field concrete work. One is the modular basin which can be precast in components and assembled in the field by a maintenance crew; the other is the concrete pipe roughness ring which can also be precast and bolted into regular culvert sections. Field evaluation for both types of dissipators were completed during CY 1978.

   Another important aspect for this study is the evaluation of the ODOT procedures for providing channel protection for culvert outlets that do not require dissipators. The evaluation focuses on the so called "Cincinnati Method" for designing rip-rap protection and will involve some 400 field sites. This work was also completed during CY 1978. The final reports for these aspects of the study are being prepared.

C. Colorado State University is conducting a study, sponsored by FHWA, to investigate scour at culvert outlets in various bed materials. The study includes four bed materials: a uniform sand, a uniform gravel, a sand-gravel mixture and a sand-silt-clay mixture. The study includes tests with various culvert diameters ranging from 4 in. to 15 in. to test the adequacy of modeling assumptions in developing design guidelines for much larger field installations.

Approximately half of the tests were completed during CY 1978, others are scheduled for completion during 1979.

Control of Local Scour Around Bridge Piers - The objectives of these studies are to investigate the mechanics of this dynamic process, the methods of accurate prediction of its magnitude, the adequate means of controlling its damaging effect to bridge piers, and the stream-related hazards to highways and bridges.

A. The contract study on the study of Scour Around Bridge Piers was completed by the West Virginia University. The objectives of this study were to collect parameters which influence scour depth around bridge piers on rivers with noncohesive soils, and to test existing methods and/or to provide an improved method for predicting the scour depth. The researchers experimented with instrumentation and monitored three bridge sites in the mid-continent - Shreveport (Louisiana), Homochitto (Mississippi), and Richmond (Texas) - for approximately five years. The portable, truck-mounted scour monitor was found very helpful as backup to the fixed monitors which had been used previously. The final report will be printed and distributed during 1979.

B. The University of Iowa completed a FHWA study on Scour Around Bridge Piers at High Froude Numbers. This study is a selective investigation to determine trends of scour under flow conditions that exceed the conditions of most of the previous tests. They are investigating scour in three sizes of cohesionless bed materials at Froude numbers that range from 0.5 to 1.5 and at depth to pier diameter ratios that range from 0.25 to 1.0. A draft final report has been submitted and will be revised for printing during 1979.

C. Tye Engineering Inc started a study, sponsored by FHWA, to deduce scour data from the Hydrologic Survey team records in Louisiana. The Hydrologic Survey team in Louisiana routinely monitors stream bed cross section at approximately 90 bridge sites. Their records provide a valuable source of field data for scour around bridge piers. The study is scheduled for completion during 1979.

D. The U.S. Geological Survey completed a research study for the FHWA entitled, "Countermeasures for Hydraulic Problems at Bridges." Guidelines were developed to assist design, construction and maintenance engineers in selecting measures that can be used to reduce bridge losses attributable to scour and bank erosion. These guidelines are based on case histories of 224 bridge sites in the U.S. and Canada, on interviews with bridge engineers in 34 States, and on a survey of published work on countermeasures. Each case history, published in volume two of the final report, includes data on bridge, geomorphic, and flow factors; a chronological account of relevant events at the site; and an evaluation of hydraulic problems and countermeasures. Performance ratings

are given for rigid and flexible revetment, flow control measures (spurs, dikes, spur dikes, jack fields, retards and check dams), and measures incorporated into the bridge design. Streams have been classified for engineering purposes into five major types, each having characteristics of lateral stability and behavior that need to be taken into account in the design of bridges and countermeasures. The final report for this study will be available in the spring of 1979.

The countermeasures project brought to light that stream alteration work for highway crossings has been curtailed in many regions and prohibited in a few. This is unfortunate in some cases because well conceived and constructed channel alterations of limited extent are often both environmentally and economically advantageous over other more extensive countermeasures. A modification to the original study is now underway to document nemerous channel changes done by highway agencies to show why they were successful or caused problems. This study will result in a separate report that can aid highway engineers in utilizing their experience in stream engineering to provide stream crossing that are environmentally sound and hydraulically efficient.

E. The USGS was also conducting a FHWA study entitled "Roughness Coefficients in Vegetated Flood Plans." It is to provide methods for estimating roughness coefficients in heavily vegetated flood plains. The study will take advantage of data collected by completed HPR studies in the Gulf Coast State of Louisiana, Mississippi and Alabama. Detailed data will be used to field validate methods of roughness coefficient estimation which have been developed theoretically and only laboratory tested. The study will strive to attain quantitative methods that are relatively simple to apply and result in accurate estimates; at a minimum it will provide comparative methods that will make present estimates more consistent.

F. A FHWA contract entitled "Methods for Assessment of Stream-Related Hazards to Highways and Bridges" was being conducted by Colorado State University. The study will result in a systematic evaluation approach for determination of hydraulic conditions at a stream crossing, giving consideration to the entire stream environment including its geology, geomorphology and landuse on the flood plain. The approach will make determination of the hazards which pose stream crossing design problems more accurate and complete. The structure of the approach will also be useful in assuring that some seemingly potential problems are not serious. By using the approach the hydraulic or bridge engineer would be less likely to overlook a hydraulic problem and may be able to complete his site evaluation with greater ease and confidence. The study is designed to be a combined research-implementation package. The research will be conducted over the next year and development follows for an additional 6 months.

G. Tye Engineering of Fairfax, Virginia completed an FHWA study titled "Debris Problems in the River Environment." This study shows that waterborne debris accumulation is a recurring problem in many regions of the U.S., and that the potential for debris hazards can be reduced by various crossing design parameters. The study provides a survey of highway related debris problems and describes the measures presently taken by highway agencies to cope with debris hazards. The research report will be available in the summer of 1979.

H. An FHWA research study was initiated with Sutron Corporation of Rosslyn, Virginia titled "Stream Channel Degradation and Aggradation: Causes and Consequences to Bridges." This study will investigate the severity of degradation and aggradation nationwide and determine the factors which are associated with these processes. The study will also provide the best available methods for determining the extent of the stream grade change given the onsite and watershed conditions.

Control of Sediment Produced by Highway Construction - This problem consists of two stages: during construction and just after the construction.

A. It is important that during the construction of highways, the sediment produced by roadway excavation and embankment construction must be controlled so it will not pollute the natural streams. Sponsored by the Pennsylvania Department of Transportation, the Pennsylvania State University and the U.S. Geological Survey continued a cooperative research study entitled "Prediction of Sediment Flow from Proposed Highway Construction Sites." This study capitalizes on the extensive work of others by utilizing modified Universal Soils Loss Equation which has incorporated a factor for surface runoff. The study will produce a computer program that can be accessed from any of the State's district offices and allows the engineer to try numerous sediment control methods mathematically before attempting to use any measures in the field.

B. The U.S. Geological Survey Hawaii District, through the sponsorship of Hawaii Department of Transportation, continued its study on Rainfall-runoff and Rainfall-sedimentation Discharge Relations in Hawaiian-type Watersheds. The objective of this study is to determine the effects of highway construction on the rainfall-runoff and rainfall-sedimentation discharge relations of a watershed in Moanalua Valley, Oahu, considering all significant basin characteristics. The results obtained will be used as a basis for deriving similar relations for other basins in Hawaii. Data collection and analysis were continued in 1978. Preparation on the final report was started.

C. The Utah State University, under the National Cooperative Highway Research Program administrated by the Transportation Research Board,

completed a 2-year study on Erosion Control During Highway Construction in CY 1977. The objective is to develop more effective techniques and materials to control erosion during highway construction activities. It consists of three major parts: to assess the effectiveness of methods presently being used throughout the United States, to develop a manual of recommended techniques and design criteria for the control of erosion, and to identify research needs. The final report consists of 3 volumes; Volume I - a summary of the research, Volume II - an erosion control manual, and Volume III - bibliography. This final report will not be published, but it will be summarized by the Transportation Research Board and then published in their regular NCHRP series as an NCHRP Research Results Digest. However, because of its importance to highway engineers, the Volume II was revised, condensed, and published as a separate manual. It was distributed by the Transportation Research Board:

> Clyde, C. G., Israelsen, C. E., Packer, P. E., Farmer, E. E., Fletcher, J. E., Israelsen, E. K., Haws, F. W., Rao, N. V., and Hansen, J., "Manual of Erosion Control Principles and Practices," Utah Water Research Laboratory Hydraulics and Hydrology Series Report H-78-002, Utah State University, Logan, Utah 84322, June 1978.

An experimental research was also conducted in 1978 in the Utah Water Research Laboratory using a rainfall simulator and test bed to determine the validity of the Wischmeier's water-caused erosion equation on steep slopes, and to test the effectiveness of selected erosion control products.

D. The USGS, district office at Harrisburg, Pennsylvania, was conducting a research project entitled "Field Evaluation of Erosion Control Measures used in Highway Construction" under the HPR program. The object of this study is to evaluate different types of erosion and sediment control measures to determine the ability of each measure to prohibit sediment from entering a stream system, and to determine if sediment concentrations and discharges return to their preconstruction levels once the construction has ended. The study area consists of five basins. Sediment ponds built on and off on streams, small rock dams, seeding, mulching and erosion control measures used before the issuance of erosion-control guidelines were being compared with the use of sediment and discharge measurements. Sediment load and turbidity were shown to be much higher in the drainage basin protected by the onstream ponds than that protected by offstream ponds. The research was complete and the final report will be available in 1979.

E. It is equally important that upon completion of highway construction, immediate and adequate protection against erosion be provided for slopes and other roadside areas affected by grading.

In most regions of the country this has been accomplished with the establishment and proper management of vegetative cover. In 1978, 17 States were conducting studies designed to improve vegetation establishment techniques and subsequent management practices. The participating States were Alaska, Alabama, California, Georgia, Hawaii, Indiana, Louisiana, Maryland, Massachusetts, Minnesota, Montana, New Jersey, Rhode Island, Texas, Washington, West Virginia, and Wyoming. Following are reports published in 1978.

1. Nolan, M. E., Spring, R. J., and Howell, R. B., "Control of Slope Erosion Using Fiberglass Roving with Vegetation," California Department of Transportation, Report FHWA-CA-TL-78-4, October 1978. (Available from NTIS).

2. Aratani, T., "Effectivess of Tubelings -- A Dryland Planting Technique," Hawaii Department of Transportation, Report FHWA-HI-HWY-73-1, November 1976. (Available from NTIS, Publication Number PB 291579/AS).

3. Aratani, T., "A Study to Determine Growth Characteristics of Selected Plants in Shade Under Structures," Hawaii Department of Transportation, Report FHWA-HI-HWY-74-2, November 1976. (Available from NTIS, Publication Number PB 291578/AS)

4. McCreery, R. A. and Spaugh, E. A., "Selection, Establishment, and Maintenance of Vegetation for Erosion Control of Roadside Areas in Georgia," Georgia Department of Transportation, Research Project No. 6907 Final Report, August 1977. (Available from NTIS, Publication Number PB 280601/AS)

5. Morre, J. D., "A Low-Cost Maintenance Program for Indiana Roadsides," Indiana State Highway Commission, Report JHRR-77-13, July 1977. (Available from NTIS, Publication Number PB279504/AS)

Control of Highway Water Quality - The objectives of these studies are to monitor the highway water pollution parameters and to devise cost effective means to control them.

A. To help States to measure their local highway water pollution parameters, FHWA published a monitoring manual which provides simplified field procedure for the water quality tests and hydrologic measurements. Besides total suspended solids (non-filtrable residue), the tests cover turbidity, pH, temperature, electrical conductance, dissolved oxygen, settleable matter, and dissolved solids (filtrable residue). Rainfall and streamflow measurements are also included.

   Bellinger W. Y., and Bergendahl, B. S., "Highway Water Monitoring Manual," report FHWA-DP-43-1, Federal Highway Administration, Region 15, Arlington, Virginia, September 1977.

If more information is desired about these research studies, inquiries should be addressed to the sponsoring agencies.

FOREST SERVICE

Research and Other Activities

Intermountain Forest and Range Experiment Station at Boise

a. Road cut Erosion. A study was conducted last summer to evaluate road cut erosion on a 44-year-old road constructed in granitic material in the Silver Creek study area. Exposed tree roots were used as erosion pins to document soil and bedrock losses. On the average, annual loss on cut slopes amounts to approximately 0.25 inches per year. Downstream sediment measurements document the influence of the long-term road cut erosion rates for the study watershed.

b. Channel Sediment Storage. Studies to document the amount of sediment storage in channels draining undisturbed forested watersheds are continuing. Detailed channel cross sections document changes in aggradation and degradation of the channel bottom. Additional inventory information provides a summary of the volume of sediment stored behind natural obstructions in the channel.

c. Sediment Outflow Measurements. Sediment outflow measurements in the Silver Creek study area are continuing. Data are collected in seven study watersheds and include bedload deposition in debris basins, and instantaneous measurements of sediment transport using DH48 samplers, Helley Smith samplers and pumping samplers. Sediment analyses include weight and chemical composition of lithic and organic sediments and particle size distribution of lithic sediments.

d. Sediment Prediction. Bedload sediment transport rates and suspended sediment concentrations have been monitored for 3 years on the Horse Creek study watersheds in Northern Idaho. Data from 10 watershed areas have been used to develop bedload and suspended sediment rating curves for the individual watersheds. Principal component analyses provide a means of classifying watersheds on the basis of geomorphic variables to explain differences in sediment processes between watersheds and/or groups of watersheds. Drainage basin area and relief ratio were the two most important descriptors for evaluating sedimentation differences.

Oregon Activities

The USDA Forest Service (S&PF) is participating in a recently initiated sediment and erosion USDA study. The study area includes Wasco, Sherman, Gilliam, Morrow, and Umatilla Counties of north-central Oregon. Results from forested lands are expected by 1981.

An erosion and sediment study has been published following a 4-year assessment of the Tillamook Bay Oregon estuary and uplands.

Washington Activities

Erosion and sediment 208 studies have been completed recently for the forested lands in the Yakima and Entiat River Basins along the east side of the Cascade mountain range.

A USDA study in which the Forest Service will evaluate and qualtity sediment and erosion from the forested lands in Asotin, Garfield, Columbia, and Walla Walla Counties in Washington has been initiated. Results are expected by 1982.

Sedimentation Research at the Forest Hydrology Laboratory, Wenatchee, Washington. A study was initiated in 1977 to determine changes in several measures of water quality, including sediment production, resulting from road construction and logging. The study site is located on the Wenatchee national Forest, near Wenatchee, Washington. Six streams, with drainage areas ranging from 70 to 2,200 acres, are monitored for runoff with periodic sampling for suspended sediment, bedload, turbidity, and certain chemical and biological properties. Logging by helicopter and tractors on five of the drainages is scheduled to be completed during the next 5 years. The first year of record indicates that sediment production from the undisturbed drainages rately exceeded 10 mg/1 even during peak snowmelt runoff.

Sediment production from the Entiat Experimental Watersheds, which were burned over by wildfire in 1970, appears to be decreasing as native and seeded vegetation reclaims the site. The following table illustrates that: (1) the watersheds were stable before the fire; (2) sediment production increased somewhat in 1971, the first year after the fire, and it increased dramatically in 1972; and (3) sediment production has decreased considerably in recent years.

The reasons for the peak sediment amounts in 1972 include: (1) minimum soil moisture storage space available because of greatly reduced evapotranspiration losses after the vegetation was destroyed; (2) record precipitation amounts; and (3) reduced infiltration capacity after the litter layer was destroyed.

Runoff and sediment sampling on the Entiat Watersheds will continue on an intermittent basis in order to determine trends back to pre-fire conditions. Present plans call for measurements to be made during 1 year out of 5.

Pounds per acre of sediment lost from the experimental watersheds before and after the 1970 wildfire

Watershed	1967	1968	1969	1970	1971	1972	1975	1976	1977
Fox	63	89	63	19	360	3390**	428	616	266
Burns	10*	10*	10*	10*	234	1650**	388	302	152
McCree	8*	8*	8*	8*	106	1260**	63	63	22

* Average values, based on 10-year accumulation removed in 1970.

** These values do not include large amounts of material lost during debris torrents.

For additional information contact Jim Eggleston, USDA Forest Service, Telephone: 447-7401.

LABORATORY AND OTHER RESEARCH ACTIVITIES

U.S. DEPARTMENT OF AGRICULTURE
SCIENCE AND EDUCATION ADMINISTRATION--AGRICULTURAL RESEARCH

There have been many new research findings and investigations in SEA-AR during calendar year 1978. Studies on erosion and sedimentation related to agriculture have been underway at 20 locations with 16 reporting for this publication. The research encompasses erosion sediment yield, sediment properties, transport, deposition, and channel and gully erosion. The studies are concerned with cultivated lands, rangelands and disturbed lands. Of particular concern is the control of nonpoint pollution and the movement of agricultural chemicals in association with eroded sediments.

ARIZONA

1. Partial area runoff analysis is an essential ingredient for understanding the principles of sediment detachment and transport from a watershed. Results from this work are as follows:

   a. Generation of overland flow on portions of small semiarid watersheds was modeled using three procedures: a regression model, a lumped linear model, and a distributed kinematic cascade model. These procedures allow determination of runoff source areas, and thus, the inference of sediment source areas.

   b. Additional runoff/sediment tracer study data were obtained on two small watersheds and a 72.6 x 20 ft experimental plot. Initial interpretations of the data suggest that runoff/sediment generation is more nearly uniform on the small watersheds on Walnut Gulch than on similar sized watersheds on the Santa Rita Experimental Range. This difference is presently unexplained and is being researched further.

2. Water quality sampling from small watersheds (< 5 ha) requires using equipment to collect unattended samples. Some equipment to accomplish this objective was developed at the Southwest Watershed Research Center involving a battery powered slot which diverts an aliquot of the water-sediment mixture at the overfall of a supercritical measuring flume. Power for the unit is obtained with a solar panel which trickle charges a 12-volt battery. Field-calibration and sediment-transport tests for this Santa Rita superciritical flume and the associated traversing slot-sampler were completed during 1978 although the report detailing the results is still pending.

   A full-scale flume and sampler were set up in the San Pedro River near Charleston, Arizona. Diversions and channels constructed allowed varying the discharge rate with volumetric measurements of the flow made with a stopwatch. Calibration of the flume was made with flume approach slopes of 1, 3, and 6 percent to determine the effects of the approach channel on the stage - discharge relationship. The approach slope does, in fact, affect the rating, as does the inclusion of high sediment concentrations (> 2% sediment). Introduction of sediment to the clearwater produced a slight head drop with deposition in the approach transition section. The slope in the approach of the flume at equilibrium approached that of the approach channel. Termination of the sediment injection resulted in erosion of the deposits and return to clearwater ratings. It may be necessary to form approach channel conditions with some stabilization provided (e.g. soil cement) to ensure stable ratings.

   The testing also included concentration determinations with the traversing slot and splitters which were compared with conventional depth integrating samplers at the flume overfall. The results indicated that care must be taken to ensure that dividers are vertical

and positioned a sufficient distance from the fixed slots to have uniform flow. The analysis and report of the testing are still continuing.

3. Sediment yields from four very small watersheds (less than 5 ha) on the Walnut Gulch Experimental Watershed varied significantly, primarily because of differences in channel and cover types. Sediment yields were several times greater from gullied than from ungullied watersheds, and as much as 10 times greater from brush-covered than grass-covered watersheds.

4. A sediment yield model derived from a complex erosion simulation model was tested using data from a small watershed on Walnut Gulch. Parameters of the model reflect soil erodibility by rainfall and overland flow. Moreover, the model accounts for deposition so that the delivery ratio concept for complex slopes is not required. Results of the testing suggest that the model is comparable to the well tested and accepted Universal Soil Loss Equation in predicting accuracy for upland areas. We expect future development presently underway will improve the accuracy.

5. Rainfall simulators offer many advantages for studying erosion on upland areas. Progress on such work is as follows:

   a. Rainfall simulator data were taken on three experimental plots (72.6 x 20 ft) on the Walnut Gulch Experimental Watershed. The simulator used was borrowed from the SEA-AR group in Sidney, MT and is patterned after the simulator developed by SEA-AR and Colorado State University personnel for the outdoor model watershed. Although the kinetic energy of the drops may be slightly below what occurs naturally, the size of the area sprinkled allows treatment of the heterogeneity of soil and vegetation, and allows rills to form. Data from these erosion plots supported the hypothesis that erosion rates on Walnut Gulch might be transport limited, since more soil was detached by raindrop impact than was transported in overland flow.

   b. Detailed experiments were conducted on the mechanisms and rates of soil detachment by raindrop impact. In cooperation with a graduate student, a rainfall simulator developed at Purdue University and the University of Arizona was used to measure detachment and transport of sediment by rainfall. This simulator creates drops having kinetic energy and mass properties very similar to that encountered in thunderstorms. Intensity is varied by changing the opening on a rotating disk beneath the nozzle. Detachment rates were related to rainfall intensity, soil cover conditions (including extent of erosion pavement), and soil characteristics. A simple mathematical model was developed to describe the detachment and transport of sediment by raindrop impact.

6. Work was completed to demonstrate the use of a stochastic simulation model to estimate sediment yield. Stochastic models of sediment yield have important application in design of dams, debris basins, and other hydraulic structures. A survey paper on available literature in this area was prepared, and specific examples were cited. The stochastic sediment yield models surveyed ranged from detailed, physically based models with distribution functions obtained by sampling from Monte Carlo simulations to empirical, event-based models for which distribution functions of sediment yield can often be obtained analytically. The best approach for any particular application depends greatly on the available data as well as the size of the watershed. Selection of the type model to use must also consider the accuracy needed for design pruposes as well as the time and expense required to operate the model.

7. Runoff/water quality samples were collected at a number of sites on Walnut Gulch, and laboratory analysis of the samples is complete. Analysis of the data from four Walnut Gulch watersheds illustrated the highly varying results with different soils and land use. Water quality indicators showed the urbanized watersheds had poorer water quality. Comparisons between the two brush-covered watersheds and a third--grass-covered and grazed--were made only on the runoff water's dissolved constituents. Despite the grazing activity, the waters were of better quality.

   A contrast in the geology between the grass and brush areas suggested that mineral sources affected qualitative changes in the dissolved solids. Calcareous soils produced waters higher in Ca and total dissolved solids and lower in other cations. Phosphate in runoff averaged higher from the grass-covered, noncalcareous area than from the brush-covered calcareous watershed. We hypothesize now that the phosphate originated from soil sources, rather than from grazing activity. Nitrate levels were comparable in runoff from the suburban area. Thus, the nonagricutlural complex of activities associated with a housing development was more detrimental to water quality than those from undisturbed or grazed rangelands.

8. The USDA-SEA, under the direction of W.G. Knisel, Jr., has undertaken a national effort on modeling nonpoint source pollution from field size watersheds. Results from this effort follows:

   a. Testing and sensitivity analysis for the SEA-AR nonpoint source pollution model. The erosion/sedimentation component of a comprehensive model developed by G.R. Foster (USDA-SEA-AR, Lafayette, Ind.) was tested using data from the Walnut Gulch Experimental Watershed. These preliminary analyses suggested that model parameters derived under more humid conditions in the Cornbelt were not applicable in semiarid regions of southeastern Arizona. However, the basic concepts incorporated in the model

appear to be reasonable, and it could be applied under semiarid conditions once experiments are conducted to determine parameter values.

b. Parameter values for a specific location on Walnut Gulch were determined by optimization using observed rainfall, runoff, and sediment data. Physical parameters (surface cover, hydraulic roughness, etc.) were then modified to simulate the influence of conservation measures, grass buffer strips, land imprinting, and revegetation, upon expected sediment yield. The results, while hypothetical, did suggest that the simulation model has promise for evaluating the influence of such conservation measures upon sediment yield from small semiarid watersheds. Moreover, the predictions suggested that these conservation measures might be expected to reduce or increase sediment yield depending upon storm sequencing and rate of grass establishment.

c. Preliminary evaluation of the applicability of the Universal Soil Loss Equation (USLE) under semiarid conditions. The USDA-SEA-AR model was calibrated using data from a rainfall simulator plot, and the resulting computed sediment yields were compared with corresponding values from the USLE. Under conditions where there is significant sediment deposition in overland flow, the improved model (including a sediment transport relationship for overland flow) produces more accurate estimates of sediment yield.

9. Work has begun (in cooperation with G.R. Foster, USDA-SEA-AR, Lafayette, Ind.) on equations to predict sediment yield from eroding channels. The procedure also related hydraulic features to channel cross-section geometry in agreement with empirical observations.

10. Cross sections established two years ago on a small gullied channel on the Lucky Hills subwatershed group on Walnut Gulch have been surveyed before and after each runoff season. Changes are occurring in both the channel and channel banks, but the seasons have been relatively dry, and the changes have been too small to quantify. These data will be used to calibrate the model cited in item 9 above.

A flat broadcrested weir was established in the channel below the southeast headcut on watershed 11 of the Walnut Gulch Experimental Watershed before the 1978 runoff season. A multipoint pump sediment sampler was installed with the weir. There was very little runoff in 1978, only enough to stabilize the channel and indicate that the sampling system was functioning properly. A sediment sampling station located in the swale above the headcut has been in operation for three years. Excellent data are being collected, and we should be able to compare data from above and below the headcut at the end of the 1979 season.

For additional information contact Dr. Kenneth G. Renard, Research Leader
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442 East Seventh Street
Tucson, Arizona 85705

COLORADO

Erosion research activities at Fort Collins, Colorado, include the following:

1. A portable rainfall simulator has been constructed and will be utilized in the summer of 1979 to investigate soil losses from lands disturbed by surface mining for coal. The rainfall simulator will be used in conjunction with natural runoff plots to compare the effectiveness of crimped straw mulch and standing annual grain mulch in reducing erosion losses.

2. A field study in Routt, County, Colorado, to determine the effects of surface mining for coal on water quality (sediment concentration and dissolved checmical concentration) is continuing.

For additional information contact D. A. Woolhiser or R. E. Smith, USDA, SEA-AR, Engineering Research Center, CSU Foothills Campus, Fort Collins, Colorado 80523.

GEORGIA

Research activities at the Southeast Watershed Research Program in Athens and Tifton, Georgia include the following:

1. Probability distributions of predicted annual sediment yield for a 24-sq. mi. watershed near Ahoskie, NC were obtained through use of a computerized recursive technique for transforming rainfall and watershed state probabilities to probability distributions of watershed outflow. Sediment yield probabilities were obtained for both present watershed conditions with conventional cropland tillage and for possible future conditions with minimum tillage of cropland. In evaluating the results, the mean of the computed sediment yield distribution for conventional tillage of watershed cropland compared favorably with the average annual sediment yield obtained from several reservoir surveys made in this and adjoining river basins.

2. A farm-by-farm survey was conducted to determine land use and crop rotations for the study area (Station K) for the study period 1974-1976. Areas of each field were determined using a photoelectric digital areameter. Conservation management practices and cropping management factors were determined for each field. Monthly composite soil losses were computed using the above information and the USLE. Monthly computed soil losses were then compared with measured suspended sediment moving past Station K, for determination of monthly, seasonal, and annual sediment delivery ratios. Monthly sediment delivery ratios ranged from 0.1 to 27.0%. Seasonal (quarterly) values ranged from 0.2 to 18.3%. Annual sediment delivery ratios were 6.6 and 8.7% for 1975 and 1976, respectively. Also, regression analyses were performed to relate sediment delivery ratios to rainfall and runoff. A prediction equation with a regression coefficient of 0.70 was derived.

For additional information contact Loris E. Asmussen, Director, USDA-SEA-FR, Southern Region, P. O. Box 946, Tifton, GA 31794

GEORGIA

1. A pilot study of sediment characteristics and channel and valley bottom morphology on Call Creek Basin has been initiated. The basin is located near the Southern Piedmont Conservation Research Center, Watkinsville, Georgia. The main objectives are: (1) to develop a basic understanding on the nature of the sediments in the selected valley bottoms with relation to the historical erosion of their uplands, (2) to assess channel and flood plain morphological changes which followed fluctuations in sediment yield under changing land-use practices, (3) to gain basic understanding on the origion and partitioning of recent sediments, and (4) to examine potential control measures for flood plain management.

2. Runoff data representing three years (1975-78) of continuous double crop-no-tillage (wheat-grain sorghum/soybeans) on small watersheds (P-1 and P-4) with $\leq$ 3.0% has been summarized. Previous (1972-75) double crop-conventional tillage years serve as background data. The number of runoff events, percent runoff, and sediment losses were 15 vs 10, 11.9 vs 5.3% and 2.81 vs 0.19 metric tons/ha (MT/ha) for conventional vs no-tillage, respectively. An inrow chisel (28 cm deep) minimum tillage technique shows considerable promise towards nearly eliminating runoff during the vulnerable chemical transport period (June-July) even on Southern Piedmont land with slope > 3.0%.

3. A rainfall simulator study was conducted on the Slate Belt soils in the Southern Piedmont to evaluate the effect of "armoring," or protection from soil erosion, by slatty rock fragments during rainfall. The study was conducted in Stanley County, North Carolina. The three soils selected were Goldston, Badin, and Georgeville. Two sites each for Goldston and Georgeville, and one of the Badin were studied. Rock fragments ranged from approximately 5 to 40% in this soil group. Three treatments were studied at each soil site. The treatments were a) natural occuring rock fragments, b) rock fragments sieved to 6" depth from plot with 1/4" screen, and c) rock fragments doubled to 6" depth. Preliminary results indicate that "armoring" is an important factor related to erosion of Slate Belt soils. Goldston ($\sim$ 40% rock fragments) eroded at the rate of 3, 24, and .04 T/ac for natural, sieved, and double fragments. Georgeville ($\sim$ 8% rock fragments) eroded at the rates of 14, 18 and 6 T/ac for the same treatments.

For additional information contact Dr. Adrian W. Thomas, Research Leader
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Idaho

Research at the Northwest Watershed Research Center, Boise, Idaho, includes the following:

1. Sediment delivery ratios, based on measured watershed sediment yields and computed soil loss by the Universal Soil Loss Equation (USLE), ranged from 0.15 to 0.47 on four rangeland watersheds in southwest Idaho.

2. Measured rill erosion from a thunderstorm July 8, 1978, was about 116 tonnes/ha on a 40 percent slope near the storm center. Peak streamflow was about 134 $m^3/sec/km^2$ from 15 ha, but no precipitation records were obtained at the site.

3. Diversion of sediment-laden streamflow for irrigation in Reynolds Creek Valley removed 560 tonnes of sediment per year, 1967-77. This was about 17 percent of the sediment coming into the irrigated area. Deposition on the cropland, assuming an aerially uniform distribution, would be about 0.08 mm/year on 690 ha.

4. Differences in computed soil loss by the USLE between grazed and ungrazed treatments were not significantly different ($P>.05$) at 5 sites, were significantly different ($P<.05$) at 3 sites, and were highly significant ($P<.01$) at a severely grazed site, based on cover and site information from the Reynolds Creek Experimental Watershed, 1972-78. Computed soil losses on areas sprayed to kill sagebrush were not significantly different ($P>.05$) from untreated areas at four dense sagebrush sites.

5. Measured sediment yields from four watersheds near Boise, Idaho, ranged from 0.02 to 0.31 tonnes/ha in 1978. The greatest sediment yields were obviously caused by roads.

6. Six years' data, including a drought year, show that an average of 4696 tonnes of dissolved solids (0.20 tonnes/ha/yr) are removed each year from the Reynolds Creek Watershed by runoff. Fifty-eight percent of this amount, an average of 3.51 tonnes/ha/yr, originates with the irrigated fields, which comprises only 3 percent of the total area. When discounting the 1977 drought year, the average dissolved solids removed are 5414 tonnes (0.23 tonnes/ha/yr), with an average of 62 percent (4.14 tonnes/ha/yr) from the irrigated land.

For additional information contact C. W. Johnson, Suite 116, Patti Plaza, 1175 South Orchard, Boise, Idaho 83705.

Indiana

Activities at Lafayette, Indiana included the following:

1. Agriculture Handbook 282, now Handbook 537 and titled "Predicting rainfall-erosion losses: A guide to conservation planning" is in print and available. The revision includes an analysis of irregular slopes, cover-management factors for conservation tillage, and extension of the USLE to the western and northwestern U.S. and Hawaii.

2. Data previously collected from natural runoff plots and used to develop the Universal Soil Loss Equation (USLE) were used to develop and test equations to estimate soil loss for individual storm events. The relationships which include erosivity factors for both rainfall and runoff significantly improved accuracy over the USLE. Slope length and steepness effects and their interactions were also studied.

3. Size distribution of aggregates in the runoff was determined at 10 minute intervals from all field rainulator experiments in 1976 and 1977. A paper presented at the Soil Science Society meetings at Los Angeles was submitted to the Journal. The effect of tillage and residue cover on N and P enrichment ratios of eroded particles was studied and discussed in a paper given at the 1978 SSSA meeting in Chicago. N and P enrichment ratios generally increased as the percentage of residue cover increased and the quantity of soil loss decreased. For similar levels of erosion, N and P enrichment ratios for no-till were 30 and 13% higher, respectively, than the ratios for moldboard plowing. N and P enrichment ratios were generally higher for sediment eroded from dry and rough surfaces than from wet and smooth surfaces.

4. Density had a much greater effect on sediment transport by overland flow than did size for coal (1.6 specific gravity) and sand particles (2.6 specific gravity) for 150 and 350 micron sized particles. When equal sized particles of coal and sand were mixed, the heavier sand segregated and deposited further upslope on concave slopes. The effect of incoming sediment rate and the presence or absence of rainfall, and particle distribution on transient sediment yield, amount of deposition and its location, and the composition of the transported sediment was studied and a model was developed that explained the major effects.

5. Data were collected and analysis is in progress to determine the effect of strips of corn stalk mulch and sod on deposition and composition of sediment carried by overland flow. Preliminary results indicate that corn stalk residue at 50% cover in strips as wide as 6 ft. will remove 2/3 of the sediment load and similar width sod strips will

remove 90%. These data are being used to validate deposition relationships for erosion and sediment yield models.

6. A model for deposition by overland flow was developed that estimates deposition amount and size composition of the transported sediment. The model was validated using data from simulated rainfall on field and laboratory concave slopes. This model is an important component in the erosion-sediment yield section of the SEA nonpoint pollution model for field sized areas.

7. An erosion and sediment yield model for field sized areas was developed from contributions by SEA personnel at several locations. The model based on fundamental erosion concepts uses overland flow, concentrated flow, and impoundment elements to characterize the major features in a field size watershed affecting erosion and sediment yield. The model requires no calibration because a modification of the Universal Soil Loss Equation and other relationships having readily available parameter values are used. Model estimates compare well with observed data and requires little computer time to analyze 20 years of record.

8. The Fiscal Year 1978 Budget for the Science and Education Administration included $400,000 for planning a National Soil Erosion Laboratory at Purdue University. The FY 1979 Budget contained $3.6 million for construction. Final plans are being reviewed and bid opening could take place in late May or early June, 1979 with occupancy in late 1980 or early 1981.

For additional information contact W. C. Moldenhauer (SEA, Agronomy Department, Life Science Building) or G. R. Foster (SEA, Agricultural Engineering Department) Purdue University, West Lafayette, Indiana 47907.

IOWA

Activities of the Watershed Research Unit at Council Bluffs include the following:

1. Hydrology and erosion studies were continued on four corn-cropped watersheds (75 to 150 acres in size) near Treynor. Two of these are contoured and conventionally tilled; one is level-terraced with double the recommended horizontal spacing, with underground pipe drains and is conservation tilled; the fourth is conservation tilled on the contour. The effectiveness of conservation tillage alone and in combination with terraces is being evaluated. Two 15-acre watersheds, one in contoured corn and one in a corn-soybean rotation, and four fractional-acre, unbordered, natural cornfield plots are instrumented.

2. Instrumentation of two standard 72.6-foot erosion plots on a 9 percent slope with up and down slope cropping were planned and will be instrumented during the spring of 1979. The data from these standard erosion plots will relate to maximum erosion for cultivated loess soils. Comparison with the four unbordered contour plots will be made to determine the effect of contouring. The data will also provide needed information for sediment yield modelling. In addition, rill and interrill erosion rates will be studied using the soil loss data and remote sensing. This information will help to evaluate the components of the Universal Soil Loss Equation (USLE), which are the basic parameters in present conceptual models, on a storm basis.

3. Remote sensing and special streamflow-sampling procedures are used to measure gully erosion rates and processes. In conjunction with this study we are attempting to define soil stresses induced by upstream-migrating headcuts by measuring geometry of vertical tension cracks and shear planes. Soil strength properties of eroding gully banks are being defined. In conjunction with the gully erosion study we are attempting to define threshold runoff rates and volumes that initiate or sustain gully erosion processes.

4. Three sidehill transects on the corn-cropped watersheds are being intensively studied using remote sensing to determine soil movement. Cesium 137 data and measurements on fractional-acre plots are expected to more clearly define mechanisms of erosion and deposition on these hillsides. This will permit comparison with soil loss by the USLE method on a storm and annual basis--information that is essential to erosion model development.

5. Studies to determine the movement of nitrogen and phosphorus with sediment and water are being continued in the loess soils. Most chemical movement is attributable to soil loss. The deep coring study showed little accumulation of nitrogen in the profile in 1978 and little, if any, downward movement of the nitrogen bulges in the soil since 1976.

Movement of chemicals in surface runoff and baseflow is determined as well as soil transport. Crop use and uptake of nitrogen and phosphorus are determined by sampling. Fertilizer additions and nutrient additions by rainfall are considered.

For additional information contact Ralph G. Spomer, USDA, SEA-AR, Room 318, Federal Office Building, P. O. Box 896, Council Bluffs, Iowa 51502.

Maryland

USDA, SEA-AR sedimentation research activities at the Hydrology Laboratory, Beltsville, Maryland, included the following:

A new sediment trap-efficiency curve has been developed relating average total reservoir capacity-average annual inflow ratio to reservoir-sediment trap efficiency. This curve is significantly lower than the one used for the past 25 years.

The distribution of deposited sediment in existing reservoirs is being investigated to obtain an intermediate data base for studying reservoir-sediment trap efficiency. Variations in deposition vs. elevation for specific reservoirs may indicate different degrees of trap efficiency.

Also under investigation are the relationships between deposited sediment particle size distribution and reservoir-sediment trap efficiency. The ability of the reservoir to trap silt and clay fractions may also be related directly to percent sediment trapped.

Sedimentation surveys have been completed on two reservoirs selected for a cooperative field study near Oxford, Mississippi and Columbia, Missouri.

For additional information contact H. G. Heinemann, USDA, SEA-AR, Hydrology Laboratory, Room 139, Building 007, BARC-West, Beltsville, Maryland 20705.

Minnesota

Current research at the St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, is on the local scour caused by a cantilevered spillway or culvert pipe discharging onto a bed of uniform size, cohesionless sand. Variables partly investigated are bed material size (0.5, 1, 2, 4, and 8 mm), effect of pipe elevation relative to the tailwater elevation (-2, -1, 0, 1, 2, 4, 8, and 16 pipe diameters), and effect of pipe slope. The temperature is maintained constant at 20° C. Dimensionless discharges $Q/\sqrt{gD^5}$ are 0.5, 1, 2, 3, 4, and 5. (Q is the discharge, g is the acceleration due to gravity, and D the pipe diameter.) The flow is interrupted and the scour hole is measured at 10, 31.6, 100, 316, 1000, 3162, and 10000 minutes after the beginning of each test. Because the apparatus would otherwise be idle for lack of a technician, scour was allowed to continue to see if it reached a limit. Sediment was still being carried from the scour hole after 14-1/4 months. Current work is on data analysis of the 48 test series and nearly 300 scour holes. Analyses made so far show that the scour hole contours, expressed as a percentage of the maximum depth of scour, can be reduced to a single set of elliptical contours for all 6 discharges, all 7 scour periods, all 5 sizes of bed material, and the 5 pipe heights for which data have been analyzed if suitable normalizing parameters are chosen. Most of the normalizing parameters have been described mathematically. Work on the remaining parameters continues. An analytical method has been developed that predicts the asympototic dimensions of the scour hole, that is the scour hole dimensions at infinite time.

For additional information contact Fred W. Blaisdell, Research Leader, SEA-AR, USDA, St. Anthony Falls Hydraulic Laboratory, Third Avenue SE at Mississippi River, Minneapolis, Minnesota 55414.

Minnesota

The following research is being conducted at the North Central Soil Conservation Research Laboratory at Morris, Minnesota.

1. Field determination of nutrients and sediment from non-point sources--Hydrological, soil, and water quality conditions were monitored and data collected for three years on a forested watershed which was then closed out in the spring of 1977. This data and data from an agricultural watershed are to be used to try and verify an erosion model based on fundamental principles. Soil surveys, farm plans, and animal, cropping, and other land use practices have been determined for an agricultural watershed. Monitoring and data collection is continuing on the watershed. This watershed became operational in 1975, about the start of the 1975-76 drought. There were no runoff events in 1976 because of the severe drought conditions, and in 1977 because the soil profile was being recharged after the drought. The first significant runoff events were in 1978.

2. Animal waste management--determine the effect on water quality, erosion, and runoff of applying animal wastes to frozen ground, and evaluate the ability of various land and cropping treatments to absorb and retain sediment and nutrients in rainfall and snowmelt runoff from livestock feedlots. The fourth and final year of a study of the effect of applying different rates of liquid manure to frozen ground in midwinter on soil loss, runoff, and nutrient losses was completed. The runoff plots which were used in the first three years of the study were closed out in 1977. However, four different rates of manure--0, 0.33, 0.67, and 1.0 inches--were applied to four small watersheds, 2 to 4 acres in size for the second successive year. As with all of the preceding years, amounts of runoff and nutrient losses from snowmelt varied inversely with the amount of manure applied. Also, based on results from two years of testing, non-structural feedlot discharge control practices were found to hold some promise for providing possible alternative methods of controlling the pollution potential of feedlot runoff.

3. Available data on sediment characteristics in the literature were combined with sediment data from current rainulator and runoff plot studies to develop some general guidelines on characteristics of eroded soil for use in new, comprehensive, physically based sediment prediction models currently being developed.

4. Consturction of an automatic "rillmeter" for measuring the development of rills in a soil is nearing completion and testing will be done this spring.

5. A comparison of corn and soybeans was begun to determine the influence of soybeans as they affect soil physical properties and soil erodibility. Factors being studied include root and shoot growth and decay from planting time, throughout the growing season, over the winter, and into the following planting season. Microbial activity is also being examined closely, along with various soil physical properties that may relate to erosion.

6. Simulated rainfall was used to apply known amounts of rainfall energy to plots on which a history of wheel traffic had been established. Standard runoff collection procedures were modified to separate erosion and runoff in the wheel track from that occurring in the non-tracked area. Various field and laboratory measurements were made on both soil and sediment samples to determine basic cause and effect relationships between wheel traffic, soil compaction, and erosion.

7. Several models that can be applied to relatively large watersheds (greater than 30,000 ha) and that are based on data generally available were developed and tested. The models estimate both average end of slope erosion and basin yield with various management practices being simulated within the segments that comprise the watershed.

For additional information contact R. F. Holt, USDA-SEA, Morris, MN 56267

Mississippi

The following research is being conducted at the USDA Sedimentation Laboratory at Oxford, Mississippi.

1. Research in cooperation with the North Mississippi Branch Experiment Station on no-till and reduced-till systems for cotton, corn, and soybeans is continuing. Use of cultivation for weed control in no-till planted corn without excessive erosion was reported previously. The first year of tests using the same system for soybeans resulted in 2 t/a soil loss, which is greater than for corn. However, the results from one year are not conclusive. Annual and cropstage C-factors for these no-till and reduced-till systems are being computed for publication and use in the USLE. First year results from no-till for cotton showed a yield reduction; however, reduced-till cotton yield was almost as high as from conventional-till cotton.

2. The rainulator is being used to study the mechanics of erosion for slopes under 3 percent primarily to verify or adjust the factors in the USLE. Studies of slope-length on 0.2 percent slopes resulted in soil loss proportional to slope length to the 0.03 and 0.15 powers for dry and wet soil conditions, respectively. Therefore, for predicting average annual soil losses, the slope-length exponent should be 0.15 or less for these nearly flat slopes in contrast to the 0.3 and 0.2 value presently used. Studies of the effect of slope were made in 1978 but the data have not been fully analyzed. Other factors influencing soil loss on low slopes will be investigated in these valley and river bottom soils that are intensively farmed.

3. Research in cooperation with the SCS on flatland watersheds in the Mississippi Delta is continuing. One pair of watersheds, 38.5 and 46.2 acres, is located on 0.2 percent graded slopes. One watershed is on Sharkey soil, the other on primarily Commerce soil; both are used for cotton production. The sediment yield is being used to verify the USLE and to compute C-factors for cotton grown on nearly flat slopes. Two more pairs of small watersheds are being used to study the effect of different cotton tillage systems and natural vs. graded slopes on sediment yield. A 640-acre watershed is being used to determine sediment yield from typical Delta flatland watersheds. All of the watershed data are also being used to develop a simple field sediment yield model based on the USLE and sediment delivery ratios.

4. In cooperation with the Soil Conservation Service, four varieties of willows were planted in 1976 at the toe of eroded banks of a 120-foot wide dredged channel in northern Mississippi. In the first year, 60 percent of the plantings failed due to high water velocities, bank slides, and poor site conditions. The surviving willows are being observed for their long-term effect on stabilizing the stream banks. Additional plantings of willow, river birch, maiden cane rhizomes, and phragmites rhizomes were made in 1978 behind 5000 feet of newly constructed jacks

and fences on Hotopha, Johnson, and Peters Creeks in Panola County near Oxford, MS. All of the maiden cane rhizomes were lost from one storm on May 5, 1978, a month after planting. Losses of willow, river birch and phragmites of 70, 63 and 50 percent, respectively, were attributed to high water velocities during the May 5 storm and to extremely dry weather that followed. Another vegetative study is being implemented in cooperation with the SCS and the Corps of Engineers. Construction on both sides of a 1600-foot reach of Johnson Creek was begun in November, 1978. The banks are being finished to a 2:1 side slope. Various combinations of rip-rap, cellular blocks and vegetation are being installed on 9 treatments along the reach. Measurements will be made to evaluate the hydraulic effects of the treatments and to determine the erosion resistance of the treatments.

5. Data showing the amount, particle size, and location of sediment deposits, and the amount of sediment outflow have been compiled for several SCS sediment detention structures. These data indicate that most of these structures trap 80 to 95% of inflowing sediment and that essentially all particles, sand size and larger, are trapped. However, the location and distribution of sediment deposits within the reservoirs varies widely. For example, in the normally ponded reservoirs the proportion of trapped sediment in the conservation (sediment) pool ranged from 50 to 100 percent. For dry reservoirs (reservoirs that only pond water for short periods during storm runoff) the proportion of trapped sediment in the conservation pool was generally much higher ranging from 75 to 100%.

6. Measurements of sediment outflow, begun several years ago on two small SCS sediment detention structures, were continued through September. The studies were terminated October 1st and instrumentation removed from the reservoirs. Detailed volumetric surveys of the reservoirs were made to determine the volume and location of sediment deposits. Sediment samples were taken to determine the volume and particle size of the deposits. Computations of sediment deposits and sediment outflow from the reservoirs have been completed but data analysis is still incomplete.

7. In the paper (Journal of Environmental Quality 7:40-44) reporting on fallout Cs-137 in sediments and soils of north central United States watersheds statistical parameters (33) were obtained and average values were used with a stepwise multiple regression and principal components analysis to determine which factors might be used to explain the variability in Cs-137 content of soils and sediments between watersheds. Although different individual variables were important in explaining the variations of the Cs-137 concentration in the soils and sediments and the buildup of Cs-137 in the cultivated and noncultivated watersheds, a comparison of the multiple regression analysis and the principal components analysis shows that both multivariate statistical techniques reduce the data to the same three basic factors which interact to explain the variation in the data variables. The three factors were (1) a rainfall-erosion factor, (2) a site for absorption of Cs-137, and (3) a measure of input of radioactivity into the watershed.

8. The relationship between surface suspended sediments and reflected solar radiation for Mississippi River Delta Lakes are being studied. Measurements of the reflected solar radiation and suspended sediment concentration in Mississippi delta oxbow lakes, including Lake Chicot, have been compared with those from the four large north Mississippi flood control reservoirs. Results indicate a slight regional difference. Detailed analytical analysis of experimental results concerning the effect of suspended sediment in the absorption of solar radiation in surface water were made. Collected data have been analyzed according to a procedure previously established and the solar energy absorbed as heat will be determined as a function of wave length, depth, suspended sediment concentration, and other sediment characteristics.

9. Continuing cooperative work with the Wisconsin Department of Natural Resources included measurements of sedimentation rates by the cesium-137 method in Waupaca and Polk counties on Pigeon River and Apple River flowage lakes. The Pigeon River Lake results indicate that in recent years there has been an acceleration in the channel erosion above the lake. The results from Apple River Lake indicate there is still considerable sediment input from upland erosion. During the 1954-64 period there was a greater input from channel erosion.

10. Soils and sediments from a number of small watersheds and reservoirs in southwest Wisconsin were sampled in 1977. A total of 57 profiles (about 300 samples) were collected. Cs-137 analyses were completed and mechanical analyses are nearly completed. The SCS in Wisconsin has asked UW-M to help them with erosion-sedimentation rates for their "doodle dams" in the southwestern part of the state.

11. Sediment profiles were samples in Wolf Lake, Yazoo Co., Mississippi in September, 1977, to determine the rates and nature of sedimentation in Mississippi River Delta Oxbow lakes. Sampling sites were located throughout the lake with a concentration in the upper end. Most of the drainage to Wolf Lake, other than drainage field drainage, is through this portion of the lake. Sediment profile samples were analyzed for Cs-137, organic matter and particle size. Cs-137 data showed sedimentation rates in excess of 5 cm (2 inches) near the head of the lake and these apparent rates decreased to 2.5 cm/year in midlake and to around 1 cm (0.5 inch) at the lower end. Most of the sediments are clays (to 80% < 2μ)and silts with practically no sand. A report was made to the Soil Conservation Service, Jackson, Mississippi, and a manuscript for presentation and publication is being prepared.

12. A cooperative study with the Vicksburg District, U. S. Army Corps of Engineers to monitor water and sediment discharges in Bear Creek, MS, was continued. Measurements of stage, velocity, temperature, conductivity, dissolved oxygen, and pH were recorded every 4 hours on magnetic tape. Tapes are read and data are transferred to the large laboratory computer. Water and suspended sediment samples were collected every 12 hours by automatic pump samplers. Bi-weekly manual measurements of stage, velocity, temperature, conductivity, dissolved oxygen and pH are

continuing at 15 sites. The data collected, and being collected, serve as the basis of an extensive evaluation of those watershed parameters believed to affect strongly sedimentation and pollutants. Monthly collection of plankton, benthos, coliform bacteria, and biochemical oxygen demand (BODs) continued through 1978. Fish species composition inventory was completed. Both plankton and benthos data have been computerized through 1978. Results for 1978 were in agreement with those for 1977, indicating poor water quality and low secondary production. High sediment concentrations adversely affect planktonic and benthonic production in winter and spring while fertilizer runoff causes eutrophication in some lakes in the system in summer. Measurements of precipitation, runoff, and sediment were continued on two single cropped (cotton) watersheds within the Bear Creek watershed. Precipitation for the first full year's operation was 46.4 inches, about 6 inches below normal. Runoff was about 19.5 inches, roughly ½ of rainfall, and sediment yield averaged about 2.6 tons per acre. Approximately 80% of the runoff and 96% of the sediment yield occurred during January, April, July, and November. Sediment concentrations were also high during the high runoff months, but varied widely with season. The maximum mean monthly concentration of 0.29 tons/acre per inch of runoff (T/A/I) occurred in April on plot #1. Runoff was twice as much in July but the average monthly sediment concentration was only 0.15 T/A/I. Lowest monthly concentrations occurred in September and October when mature cotton provided comparatively good cover. Sediment particle size data for two relatively large storms in April and November showed that only minute quantities of sand are removed from the fields. For the two storms approximately 95% of the sediment was finer than 16 microns and 70 to 95% was finer than 2 microns. Samples from several storms were analyzed by a subcontract for pesticide (selected chlorinated hydrocarbons) content. Concentrations for some, particularly toxaphene and DDT, varied widely during storms and between storms. This is noteworthy because none of the pesticides were applied to the fields during 1977 or 1978. Presumably, significant amounts of some pesticides applied in prior years remain on the fields. Randomly selected soil samples from 13 sites on the plots showed residual concentrations of toxaphene ranging from 21 to 2270 ng/g and DDT concentrations from "non detectable" to 476 ng/g.

13. A study of the hydrological, chemical and biological regimes of Lake Chicot, Arkansas, is continued. Six monitoring stations, established in 1976, have been monitored at bi-weekly intervals. Stage, velocity, pH, temperature, conductivity and dissolved oxygen were measured. Two automatic stations have been established and will monitor and sample selected parameters on an 8-hour basis. Data from the continuous sampling are stored on magnetic tape and processed by the computer. Measurements of plankton, chlorophyll, benthos, coliform bacteria, and biochemical oxygen demand (BODs) were continued through 1978. In addition subcontract work (University of Arkansas, Monticello) continued measurements of primary productivity. Fish samples were taken from both sections of the lake in September and were analyzed for pesticides. Plankton and chlorophyll data have been computerized through 1978 and

chlorophyll data show a strong negative response to total solids entering the lower lake. Benthos, likewise, show a poor habitation of areas where heaviest sediment deposition occurs. The upper section of the lake, with little inflow, was better in quality than the lower lake.

14. The SCS is conducting a study on erosion and sediment yield data of ten Water Quality Study areas (WQSA) in South Dakota. The Sedimentation Laboratory was asked to cooperate in a study on Lake Herman. In July, 1978, seven profiles were sampled in Lake Herman. Cs-137 and mechanical analyses are being run on these samples. The dual gamma density probe was used to measure in situ densities of these profiles. Reports on this work will be available in early 1979.

15. Row sideslope erodibility and sediment size distributions were evaluated for 10 soils at 4 rain intensities. Erosion rates were lowest for 2 well-aggregated upland soils and highest for 2 poorly aggregated bottomland soils. Sediment size varied considerably from soil to soil, but it changed little with major changes in rain intensity, storm duration, and cover for any given soil. One soil was studied at 4 crop stages during the cotton season, and erosion decreased for each successive stage. However, studies at these same crop stages with all cover removed showed that crop canopy was not the only effect since the erodibility of even the bare soil decreased through the season. Erosion rates from all soils and cover conditions showed that row sideslope erosion varies as the rain intensity squared.

16. Soil water hydrologic investigations were initiated on in situ measurements of hydraulic conductivity on various soils of the same catena and measurements of areal variations in soil water content on field size watersheds. The first soil (Grenada) represents a fragipan soil which showed extremely slow internal drainage with variation in moisture content of less than 2 to 3% over a 2½ month period. Measurements of soil water content on field size watersheds in cotton production were conducted with an areal frequency of 24 locations per acre during the growing season. The results are still being analyzed. Texture measurements will involve both moisture content determinations and potential measurements.

17. Investigations have been made of the lateral variation of boundary layer thickness and local friction coefficient in a rectangular channel. The boundary layer thickness was found to be at a maximum at the channel centerline, and to decrease toward the sidewall of the channel. The local skin friction coefficient tended to be at a minimum at the channel centerline, and to increase toward the sidewall. The rate at which lateral variation of the boundary layer thickness occurred was higher in a relatively deep flow than it was in a shallow flow. The local friction coefficient, on the other hand, increased more rapidly toward the sidewall in a relatively shallow flow than in a deep flow. This evidence of the three dimensional quality of open channel flow will be of use in flow simulation in mathematical models.

18. A 250-ft. test channel with a flow capacity of up to 150 cfs. has been equipped for making river-scale studies of sediment transport with better control of the independent variables than can be maintained in actual rivers. Instruments include continuous sediment load measuring devices, and automated depth and bed profile recorders. All data collected will be sent directly from experiment to computer for analysis concurrent with the experiment. Information obtained will be used in establishing better criteria for stable channel designs.

19. A 100-ft. flume with an 18 cfs maximum flow capacity has been equipped for experimenting with alluvial channel resistance coefficients in unsteady flows. The experiments in this flume will be entirely controlled by a totally dedicated computer, which will impose a preprogrammed unsteady flow during an experiment, and concurrently acquire and analyze the data from the experiment. Instrumentation includes depth and discharge controls, and a series of water depth, sand depth, discharge, and temperature measuring instruments.

20. Predicting soluble PO_4-P concentrations in runoff from croplands on a storm basis must consider a number of complex, interacting P inputs, including soil (sediment), fertilizers, crop residues, and possibly leaching of P from growing crops. Using a simple approach to this problem for 208 planners, equilibrium phosphorus concentration (EPC) values determined from soil P sorption isotherms provided a good estimate of the annual mean soluble ortho-P concentrations measured in runoff from Mississippi Delta watersheds, but single storm runoff P concentrations varied appreciably from this mean, as expected. On Mississippi upland soils, EPC values predicted the annual mean P concentration within a factor of 2 to 4, even when P was released from crop residues in no-till practices.

21. In north Mississippi, no-till practices significantly reduced the total sediment plus solution losses of P and organic carbon (TOC) in runoff. Concentrations of solution and sediment TOC were greater from pine-forested watersheds than from conventional till and no-till corn, with a greater proportion of the TOC transported in the aqueous phase. Annual average BOD_5 concentrations in runoff from conventional and no-till corn were low (20 and 18 mg/l, respectively). BOD_5 losses were lower from no-till because of the lower runoff volume. Thus, no-till was effective in reducing the carbonaceous loading to surface waters.

22. Chemical transport modeling requires predicting insecticide washoff during rainstorms from plant canopy to soil and its subsequent transport in runoff and sediments. Toxaphene, a chlorinated camphene insecticide, is used in the Mississippi Delta to control bollworms and tobacco budworms (Heliothis sp.) during July and August, months of high-intensity thunderstorms. Using simulated rainfall, toxaphene washoff from a mature cotton canopy was found to be independent of rainfall intensity when 2.4 cm of rain was applied at 1.27, 2.5, 5.1, and 10.2 cm/hr. Toxaphene washoff was relatively small, amounting to only 2 percent of the

2.2 kg/ha applied. Only the rainfall amount affected toxaphene washoff. This greatly simplifies modeling the movement of toxaphene from plant canopy to soil during natural rainfall events when intensities vary greatly within events and from storm to storm.

23. Identification of the stratigraphic units within the alluvial valleys of the study area has continued. The dominant units exposed on channel banks include 1) a thin to 6 feet thick, surficial veneer of relatively recent alluvial fill associated with man's activities, 2) a relatively unweathered paleosol immediately below the recent alluvial fill and 3) a highly weathered (older) paleosol, frequently truncated, directly beneath the recent alluvial fill or the younger paleosol. The older paleosol has distinctive polygonal structure in the B horizon and is the most frequently observed unit. These two paleosols exhibit different modes of bank failure. The younger paleosol, has a near isotropic structure and fails by the development of vertical tension cracks parallel with the bank. This crack development ultimately results in failure of large sections of bank material. The polygonal structure of the older paleosol induces block type failure. The weakly cohesive material between the blocks is preferentially eroded, effectively isolating individual blocks, resulting in gravity induced failure.

24. Observations in watersheds throughout the Yazoo basin have revealed the abundant occurrence of well preserved wood deposited as discrete layers within the alluvial fill. These wood layers frequently occur at the base of the paleosols and form a rather sharp interface. The wood layers are composed of whole tree trunks, limbs, bark, leaves, and nuts. The ages of several wood layers were measured by C-14 dating to determine the age of the overlying stratigraphic units. Of the 39 samples dated thus far, 2 have ages greater than 40,000 years, 14 have ages between 9,500 and 12,500, 4 have ages between 4,500 and 6,000 and 19 have ages less than 2,500 years; and only 4 samples have ages less than 200 years. No wood samples have been found for the time intervals from 12,500 to 4,000 years before present nor from 6,000 to 9,500 years. Any implications of these wood deposits with general channel stability (due either to climatic or base level change) is premature at this time, and must await further dating and correlary data.

25. Construction was started on the first 3 of 14 flumes for supercritical streamflow/sediment sampling on Goodwin Creek Watershed. Design work is complete for the other sites. Temporary stage recorders have been installed at two streamflow sites in the watershed to provide records until the major stations are completed. The measuring station at site 10, a small timbered watershed, was completed by laboratory staff. Instrumentation includes a raingage, water level recorder, pumped sediment sampler and water temperature. A VHF radio telemetry system was installed at this site and is fully operational. The remote data station is automatically polled each 30 minutes by a computer at the laboratory which then receives and stores the data. The other 13 remote data stations will be installed as soon as the Corps of Engineers finishes construction of

the supercritical measuring flames. The climatological station near the center of the watershed has been instrumented and includes a standard raingage, pit raingage, evaporation pan, solar radiometer, and sensors for wind speed and direction, relative humidity, air temperature, and barometric pressure. Twenty-four raingages have been installed on the watershed. A large pond in the watershed has been surveyed and instrumented with a stage recorder. This pond will be used in the reservoir modeling studies.

For additional information contact D. G. DeCoursey at the USDA Sedimentation Laboratory, P. O. Box 1157, Oxford, Mississippi 38655.

MISSOURI

1. Research was redirected on the forty erosion plots at the Midwest Claypan Experiment Station near Kingdom City (formerly McCredie). Soil and slope inventory measurements were made and plot slopes were reshaped to obtain uniformity among plots. The plots were chisel plowed, fertilized and seeded to wheat in the fall. The plots will be planted to soybeans for two to three years to establish soil chemical and physical uniformity among plots and to study residual management effects on runoff soil loss, associated nitrogen and phosphorus losses and crop production. Soybean management treatments will be established on the plots in 1978 to establish a permanent record of information for each of the plots for the period of 1941 through 1978. The information includes: date and type of field operation; planting date, species, pattern and rates; fertilization date, rate, placement and form; pesticide application date, type, rate and procedure; supplemental water application date and amount; crop production of grain, residue, harvest dates, and residue management; precipitation, runoff and soil loss by storm events; nitrogen and phosphorus concentration and losses by storm events.

2. Trap efficiency research by the SEA Watershed Research Unit on three central Missouri reservoirs was continued through 1978. This research included the measurement of inflow and outflow of sediment to determine trap efficiency on a storm basis. To improve the quality of water stored in small reservoirs, a bottom-withdrawal spillway is being studied to see what effect it has on the water quality in and downstream from two reservoirs. This spillway is expected to lower the trap efficiency because it eliminates the "dead" storage below the spillway intake which, in turn, reduces the detention time of storm runoff since density currents are discharged as soon as they reach the lowest point in the reservoir. As an example of the effect this spillway has on water quality, the phosphorus discharged from the spillway was compared to that stored in the reservoir. For one reservoir, the ortho-P discharged was 1.2 times greater than that stored, nitrate-N was 1.0 times greater, and ammonium-N was 1.8 times greater. For the other reservoir, ortho-P was 7.4 times greater, nitrate-N was 1.3 times greater, and ammonium-N was 1.9 times greater in the outflow than that stored in the reservoir. Sediment was likewise greater in the outflow than in the stored water. These trends should reduce the problems of sedimentation and eutrophication in reservoirs equipped with the bottom-withdrawal spillway.

For additional information contact Carroll R. Amerman, Watershed Research Unit, 207 Business Loop 70 East, Columbia, Missouri 65201.

NEBRASKA

Research on erosion and sedimentation conducted from Lincoln, Nebraska, is concerned with the control of runoff and erosion on row-cropped lands where conservation practices are lacking and the undulating topography and slopes are such that terraces cannot be installed and farmed with reasonable effort. Small areas of these lands often contribute major sediment production within a watershed. Control measures have been serious, continuing concerns on the Missouri Valley Deep Loess and Table Land areas subject to high-intensity rainfall. Two representative field sites were selected in Stanton County, Nebraska, 100 and 112 miles north of Lincoln. One small, untreated watershed on each field (4 and 6 acres) was instrumented with a flume and an automated, programmed sampler to measure runoff and soil loss in late 1976. Installation of basins (discontinuous terraces) with selected designs (2-, 5-, 10-year frequency storms) and spacings on subwatersheds in the fields was initiated in 1978 and will be completed in 1979. The basins impound runoff and control discharge through riser inlets and underground pipe. Bedloads and suspended sediments are deposited on the inundated area. Runoff in excess of the detention storage and discharge capacity of a basin is discharged as overland flow on the adjacent ridge. Runoff from the basins is measured and sampled and accretion of soil in the basins will be measured under conservation tillage. The basins are made by constructing fills generally across a drainway and across the slope and parallel to the direction of row-crop planting. The Soil Conservation Service and the Lower Elkhorn Natural Resource District, cooperating in the site selection, design, installation, and data collection. Despite construction disturbance, runoff discharges from recently installed basins in 1978 contained greatly reduced solids contents compared to discharge from the untreated, row-cropped drainage area. Discharges after inundation of soil surfaces in the basins had even lower solids contents. The farmer experienced no problems in his first season's field operations with the "discontinuous terraces."

For additional information contact Norris P. Swanson, Research Leader, USDA-SEA-AR, Room 5 Agricultural Engineering, University of Nebraska, Lincoln, Nebraska 68583.

OHIO

Sedimentation activities at the North Appalachian Experimental Watershed, Coshocton, Ohio, include the following:

1. Runoff and soil loss data, by storms, have been tabulated for four watersheds (0.65 to 1.69 acres in size) for conventionally tilled corn. The period of record, for a four-year crop rotation, extended from 1944 through 1969 with 137 storms available for analysis. An evaluation has been made of the sediment yield prediction efficiency of the Universal Soil Loss Equation by applying three common methods of computing the erosinity index. A more efficient method is sought by correlating the products of basic rainfall/runoff energy parameters and soil erosion on a storm basis. For further information contact W. M. Edwards, P. O. Box 478, Coshocton, Ohio 43812.

2. Current research on the impact of surface mining on the hydrology and water quality of watersheds subjected to surface mining involve the use of experimental watersheds and erosion plots. For four watersheds, 30 to 50 acres in size, were monitored during the premining phase for suspended solids. The average concentration of suspended solids in storm runoff ranged from 118 to 1110 mg/l, and for baseflow the range was from 44 to 249 mg/l; the higher concentrations were associated with the watersheds exhibiting the greatest premining disturbance. A number of erosion plots, varying in slope and slope length, are to be installed on disturbed land areas in the vicinity of the study watersheds. Data from the plots and watersheds will be used to investigate erosion and sediment yield models, and to develop new techniques for predicting storm erosion from disturbed lands on steep slopes. For further information contact W. R. Hamon or J. V. Bonta, P. O. Box 478, Coshocton, Ohio 43812.

Oklahoma

1. At the Southern Plains Watershed & Water Quality Laboratory, Chickasha, collection of suspended sediment transport data was discontinued in 1978 at most all past reported gaging stations. Data collection continued on the Little Washita River (D.A. = 208 $m.^2$) near Ninnekah and will be used to assay nonpoint pollution changes of the Model Implementation Project (MIP) being administered and sponsored by the SCS and EPA.

2. No reduction in sediment yield occurred when the watersheds of East Bitter Creek (D.A. = 35 $mi.^2$), West Bitter Creek (D.A. = 61 $mi.^2$), and Little Washita River (D.A. = 208 $mi.^2$) were treated with flood-retarding reservoirs. This was determined with double-mass curves of accumulated sediment yield from treated watersheds vs. that from adjacent untreated watersheds. The findings were unexpected because 5 other watersheds previously treated had sediment yield reductions ranging from 40 to 60 percent. Other analyses are planned that may explain the anomaly.

3. Sediment yield estimates by the Modified Universal Soil Loss Equation (MUSLE) and erosion estimates by the Universal Soil Loss Equation (USLE) were compared with measured yields from 12 watersheds for an 11 year period. The MUSLE underestimated average yields on the cropland watersheds, where slopes are less than 1%, by a factor of 1.7 to 3.2 and overestimated average yields on the rangeland watersheds, where slopes are about 3%, by a factor of 2.6 to 7.3. The USLE erosion estimates on the cropland watersheds were 1.8 to 6.0 times higher than measured yields and were 3.2 to 45.5 times higher on the rangeland watersheds.

4. Sediment yield data, in connection with hydrologic, and surface runoff water quality, was continued at El Reno, Okla., and Woodward, Okla., and activated at Bushland, Texas. From eight 4-acre range watersheds at El Reno with precipitation about 3.6 inches below normal, the average runoff was 0.64 inches and an average sediment yield of only 8 pounds per acre. From 4 small range watersheds ranging in size from 6.7 acres to 13.8 acres at Woodward, Okla., runoff varied from 0.46 inches with a sediment yield of 164 pounds per acre on an 11.8 acre nongullied watershed to 1.48 inches with a sediment yield of 2711 pounds per acre on a 13.8 acre watershed with a single incised gully. From 3 cropland watersheds ranging in size from 5.1 acres to 8.1 acres at Bushland, Texas, runoff averaged about 6.10 inches with an average sediment yield of about 5100 pounds per acre.

5. The reservoir trap efficiency study was continued at SCS flood-retarding structure 3 on West Bitter Creek. Suspended sediment concentration and particle-size data are being taken on the inflow and outflow so that the trap efficiency of each flow event by particle-size range can be obtained.

6. Of the 14 flood-retarding reservoirs with sedimentation ranges, none were resurveyed this year.

7. Particle size analysis of suspended sediment samples with the Sedigraph, without dispersant and then with dispersant, indicates particle aggregation under in stream conditions. Some of the particles in the 15 to 25 microns and smaller sizes are aggregated into larger particles. Adding dispersant, increased the percent of particles finer than this range and decreased the percent of particles coarser than this range. The average increase in particles <2 microns for 30 samples from one watershed was 12%, with a range of 4 to 35%.

For additional information contact, R. G. Menzel, Acting Laboratory Director, USDA, Science and Education Administration, Southern Plains Watershed and Water Quality Laboratory, 801 Wilson St., Durant, Okla., 74701, or G. Coleman, Acting Location Leader, USDA, Science and Education Administration, Southern Plains Watershed and Water Quality Laboratory, P.O. Box 400, Chickasha, Okla. 73018.

WASHINGTON

The following research is being conducted by the Land Management and Water Conservation Research Unit at Pullman, Washington:

1. A portable, photographically recording rill meter is being used to measure soil loss from rills from selected field sites at the end of the erosion season. The purposes of the study are to determine (1) the effect of slope length and steepness on soil loss, and (2) the variation of soil loss across the climatic belts of eastern Washington and northern Idaho. The results from part (1) of this study, initiated in 1973, will be used in developing a second generation adaptation to the Pacific Northwest of the Universal Soil Loss Equation.

2. Runoff plots have been installed on cropland in eastern Washington and northern Idaho to determine the effect of slope length on relative magnitudes of rill and sheet erosion, as well as the effect of certain erosion control practices on runoff and erosion.

3. Runoff plots have been installed on cropland and bluegrass seed fields in eastern Washington on different crop treatments including grass, grass sod residues, conventionally and no-tillage planted fall-seeded wheat, and various primary tillages of wheat stubble. The purpose is to determine the effect of crop treatments on (1) soil loss, (2) runoff, and (3) nitrogen and phosphorous in runoff water. Instrumentation includes frost depth meters to determine the effect of crop treatment on frost depth and subsequent runoff and erosion following periods of frozen soil.

4. A crop management factor evaluation model is being developed for use in the adaptation of the Universal Soil Loss Equation to the Pacific Northwest. The model will consider such factors as surface residue, tillage operations, vegetative cover, and soil moisture content prior to and during the winter erosion season.

5. A sediment transport and delivery rate study is being conducted on a 27.1 square mile watershed. A PS-69 automatic pump sampler, located near a USGS gaging station, is used to collect suspended sediment samples. Several channel cross sections are measured before and after the erosion season to estimate the amount of channel aggradation or degradation and are used with upland erosion and valley deposition measurements and estimates to calculate delivery ratio. Data from the study are also being used to determine sampling frequency requirements for streams in agricultural watersheds of the Palouse.

For additional information, contact Donald K. McCool, USDA, SEA, AR, Agricultural Engineering Department, 219 Smith Engineering Building, Washington State University, Pullman, WA 99164.

SOIL CONSERVATION SERVICE

Publications and Special Studies

"Soil Erosion and Sediment Yield in Ten Water Quality Study Areas in South Dakota," USDA, SCS, Huron, South Dakota 1978, 29 pages.

Finkelson, Ordean M., "Sediment Yield Versus Gross Erosion in Minnesota," USDA, SCS, St. Paul, Minnesota. Presented at the American Society of Agricultural Engineers, 1978 Winter Meeting, Chicago, Illinois.

All states except for Alaska are collecting data on stream, roadside and gully erosion. This study is Phase II of the National Erosion Inventory.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1980 O— 311-344/32