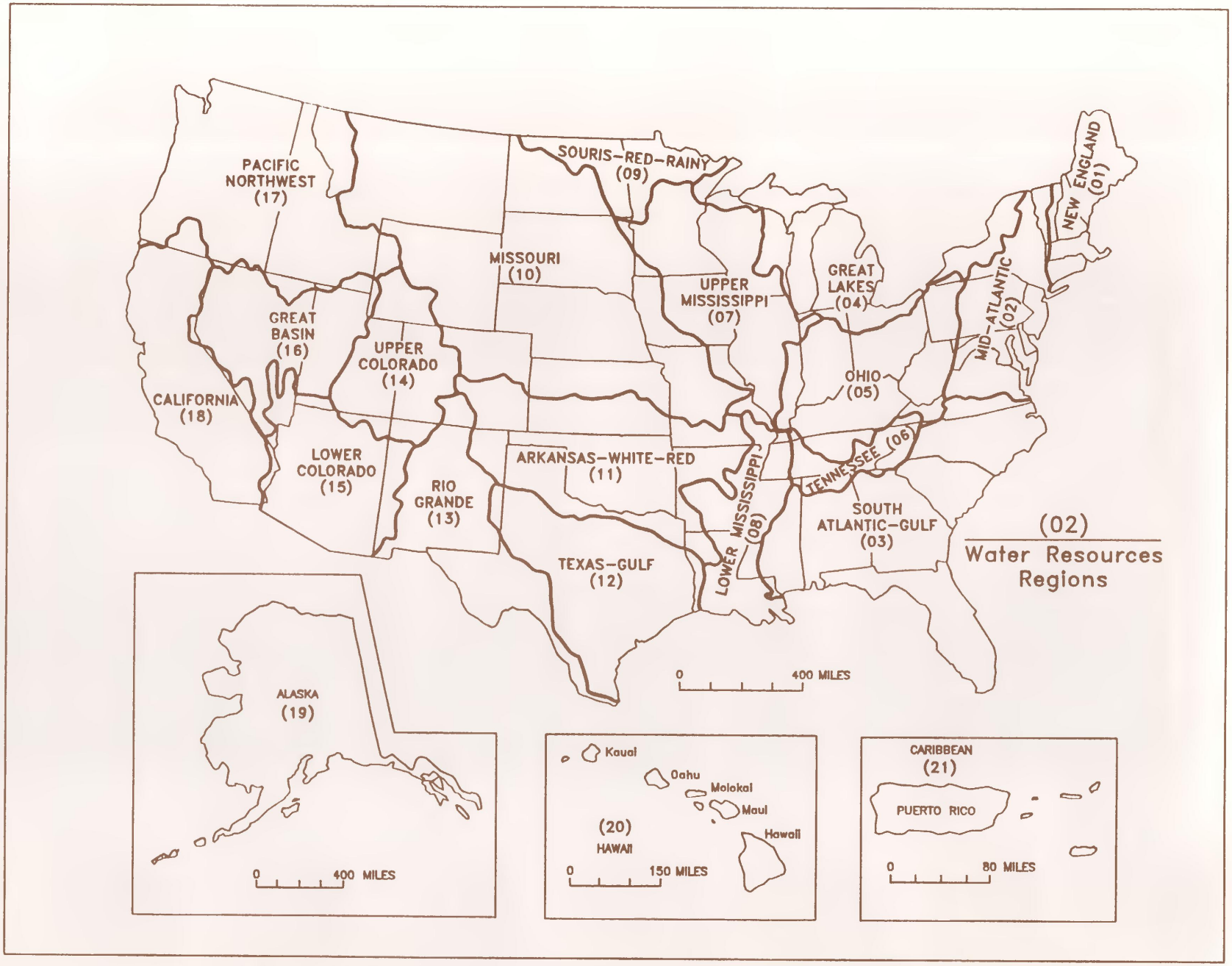
INTERAGENCY ADVISORY COMMITTEE ON WATER DATA

NOTES ON SEDIMENTATION ACTIVITIES CALENDAR YEAR 1992

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
Water Resources Division
Office of Water Data Coordination
417 National Center
Reston, Virginia 22092



Water Resources Regions of the United States

NOTES ON SEDIMENTATION ACTIVITIES CALENDAR YEAR 1992

the
Subcommittee on Sedimentation
of the
INTERAGENCY ADVISORY COMMITTEE ON WATER DATA

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
Water Resources Division
Office of Water Data Coordination
417 National Center
Reston, Virginia 22092

March 1994

PREFACE

This report is a digest of information furnished by Federal agencies conducting sedimentation investigations. The decision to publish the report was made in 1946, from a proposal by the Chairman of the Federal Interagency River Basin Committee, Subcommittee on Sedimentation. The subcommittee approved the proposal and agreed to issue this report as a means of effecting better coordination of the work of various Federal agencies in the field of sedimentation. The report was issued on a quarterly basis in 1946 and 1947, from 1948 to 1953 reports were issued every 6 months, and from 1954 to present, the report has been issued annually.

Descriptions of work in progress or planned are included in the report, as well as important findings, new methods, new publications, information relating to laboratory and research activities, and other pertinent information. The material is organized by major drainage regions in the conterminous United States, Alaska, Hawaii, and the Caribbean.

Until 1979, each issue of this publication contained a list of stations where sediment data are collected giving the station location, drainage area, and other related information. Because the station list did not change significantly from year to year, it was eventually deleted from the publication. Also, because most users of the station list were only interested in the stations in a certain geographic area, it was felt that their needs could be served more efficiently by acquiring the necessary information through the National Water Data Exchange (NAWDEX). Therefore, locations and addresses of NAWDEX assistance centers are included in this report.

Information for this report was contributed by the representatives of participating Federal agencies. Suggestions for improving the report are welcome.

CONTENTS

[1]Numbers in parentheses refer to Water Resources Regions shown on the map on the inside of the front cover.

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SUBCOMMITTEE ON SEDIMENTATION

Chair FY 1992

Richard B. Perry
National Oceanic and Atmospheric Administration

Alternate Chair FY 1993

Yung-Huang Kuo
U.S. Army Corps of Engineers

Representatives

Alternates

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David A. Farrell
Agricultural Research Service

Warren C. Harper
Forest Service

Jerry Bernard
Soil Conservation Service

Department of Commerce

Richard B. Perry
National Oceanic and Atmospheric Administration

David B. Duane
National Oceanic and Atmospheric Administration

Department of Defense

Yung Huang Kuo
Army Corps of Engineers

Lewis A. Smith
Army Corps of Engineers

SUBCOMMITTEE ON SEDIMENTATION—Continued

Representatives	*Alternates*

Department of Housing and Urban Development

Truman Goins
Office of Environment and Energy

Department of the Interior

Charles R. Smith
Bureau of Indian Affairs

Ron Huntsinger
Bureau of Land Management

James Cook
Bureau of Mines

Allen Perry
Bureau of Mines

Robert Strand
Bureau of Reclamation

Roy Rush
Bureau of Reclamation

Charles W. Boning
U.S. Geological Survey

William L. Jackson
National Park Service

Ranvir Singh
Office of Surface Mining

Department of Transportation

D.C. Woo
Federal Highway Administration

SUBCOMMITTEE ON SEDIMENTATION—Continued

Representatives	*Alternates*

Independent Agencies

Francis R. Skidmore
Council on Environmental Quality

Christopher F. Zabawa
Environmental Protection Agency

Shou-shan Fan
Federal Energy Regulatory Commission

Andrew Seiger
International Boundary and Water Commission

Paul Storing
International Boundary and Water Commission

Terry (Ted) L. Johnson
Nuclear Regulatory Commission

Fred Ross
Nuclear Regulatory Commission

Robert T. Joyce
Tennessee Valley Authority

OWDC Liaison: G. Douglas Glysson

Working Group

Technical Committee on Sedimentation Working Groups

Chair: James Fagg, Bureau of Land Management

LOCATIONS OF NAWDEX ASSISTANCE CENTERS

ALABAMA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	520 19th Avenue, Tuscaloosa, AL 35401	
TELEPHONE:	(205) 752-8104	Central Time
NAWDEX CONTACT:	Will Mooty	

ALASKA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	4230 University Drive, Suite 201, Anchorage, AK 99508-4664	
TELEPHONE:	(907) 786-7100	Alaska Time (Pacific time minus 1 hour)
NAWDEX CONTACT:	Liska Snyder	

ARIZONA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	375 S. Euclid Avenue, Tucson, AZ 85719	
TELEPHONE:	(602) 620-6120	Mountain Time
NAWDEX CONTACT:	Christopher Smith	

ARKANSAS

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	700 West Capitol, 2301 Federal Office Building, Little Rock, AR 72201	
TELEPHONE:	(501) 378-6391	Central Time
NAWDEX CONTACT:	John E. Owen	

CALIFORNIA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	2234 Federal Building, 2800 Cottage Way, Sacramento, CA 95825	
TELEPHONE:	(916) 978-4643	Pacific Time
NAWDEX CONTACT:	John Bader	

LOCATIONS OF NAWDEX ASSISTANCE CENTERS—Continued

CALIFORNIA—Continued

ORGANIZATION:	Earth Science Information Center, U.S. Geological Survey	
ADDRESS:	Room 3128, Building 3 (MS 533), 345 Middlefield Road Menlo Park, CA 94025	
TELEPHONE:	(415) 329-4390	Pacific Time
NAWDEX CONTACT:	Jack Mottram	

COLORADO

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	Building 53, Denver Federal Center, Mail Stop 415, Box 25046, Lakewood, CO 80225	
TELEPHONE:	(303) 236-4882	Mountain Time
NAWDEX CONTACT:	Vacant	

CONNECTICUT

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	Abraham A. Ribicoff Federal Building, 450 Main Street, Room 525, Hartford, CT 06103	
TELEPHONE:	(203) 240-3060	Eastern Time
NAWDEX CONTACT:	Lawrence A. Weiss	

DELAWARE

(See U.S. Geological Survey Office in Maryland)

DISTRICT OF COLUMBIA

ORGANIZATION:	Earth Science Information Center, U.S. Geological Survey	
ADDRESS:	Room 2650, 1849 C Street, NW, Washington, DC 20240	
TELEPHONE:	(202) 208-4047	Eastern Time
NAWDEX CONTACT:	Stephen P. Shivers	

FLORIDA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	227 N. Bronough Street, Suite 3015, Tallahassee, FL 32301	
TELEPHONE:	(904) 681-7620	Eastern Time
NAWDEX CONTACT:	Linda Geiger	

FLORIDA—Continued

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 9100 N.W. 36th Street, Miami, FL 33122
TELEPHONE: (305) 526-2895 Eastern Time
NAWDEX CONTACT: George A. Karavitis

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 224 West Center Street, Suite 1006, Altamonte Springs, FL 32714
TELEPHONE: (407) 648-6191 Eastern Time
NAWDEX CONTACT: Larry Fayard

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 4710 Eisenhower Boulevard, Suite B-5, Tampa, FL 33634
TELEPHONE: (813) 228-2124 Eastern Time
NAWDEX CONTACT: Jack Rega

GEORGIA

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 3039 Amwiler Road, Suite 130, Peachtree Business Center, Doraville, GA 30360
TELEPHONE: (414) 986-6860 Eastern Time
NAWDEX CONTACT: Keith W. McFadden

HAWAII

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 677 Ala Moana Boulevard, #415 Honolulu, HI 96813-5412
TELEPHONE: (808) 541-2653 Alaska-Hawaii Time (Pacific Time minus 2 hours)
NAWDEX CONTACT: Iwao Matsuoka

IDAHO

ORGANIZATION: U.S. Department of the Interior, Bureau of Land Management
ADDRESS: 3948 Development Avenue, Boise, ID 83705
TELEPHONE: (208) 384-3001 Mountain Time
NAWDEX CONTACT: Mark Vinson

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 230 Collins Road, Boise, ID 83702
TELEPHONE: (208) 334-1750 Mountain Time
NAWDEX CONTACT: Luther C. Kjelstrom

LOCATIONS OF NAWDEX ASSISTANCE CENTERS—Continued

ILLINOIS

ORGANIZATION:	Illinois State Water Survey Division	
ADDRESS:	2204 Griffith Drive, Champaign, IL 61820	
TELEPHONE:	(217) 333-4952	Central Time
NAWDEX CONTACT:	Robert A. Sinclair	
ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	Busey Bank County Plaza, Fourth Floor, 102 East Main Street, Urbana, IL 61801	
TELEPHONE:	(217) 398-5595	Central Time
NAWDEX CONTACT:	Gary O. Balding	

INDIANA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	5957 Lakeside Boulevard, Indianapolis, IN 46278-1996	
TELEPHONE:	(317) 290-3333	Eastern Time
NAWDEX CONTACT:	Don Arvin	

IOWA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	Room 269, Federal Building, 400 South Clinton, Box 1230, Iowa City, IA 52244	
TELEPHONE:	(319) 337-4191	Central Time
NAWDEX CONTACT:	Rodney Southard	

KANSAS

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	4821 Quail Crest Place, Lawrence, KS 66049	
TELEPHONE:	(913) 842-9909	Central Time
NAWDEX CONTACT:	Claude Geiger	

KENTUCKY

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	2301 Bradley Avenue, Louisville, KY 40217	
TELEPHONE:	(502) 582-5241	Eastern Time
NAWDEX CONTACT:	Sandy J. Couts or Harry C. Rollins	

LOUISIANA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	P.O. Box 66492, 6554 Florida Boulevard, Baton Rouge, LA 70896	
TELEPHONE:	(504) 389-0281	Central Time
NAWDEX CONTACT:	Wendy Lovelace	

MAINE

(See U.S. Geological Survey Office in Massachusetts)

MARYLAND

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	208 Carroll Building, 8600 LaSalle Road, Towson, MD 21204	
TELEPHONE:	(410) 828-1535	Eastern Time
NAWDEX CONTACT:	Robert W. James, Jr. or John F. Hornlein	

MASSACHUSETTS

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	28 Lord Road, Suite 280, Marlborough, MA 01752	
TELEPHONE:	(508) 485-6360	Eastern Time
NAWDEX CONTACT:	Thomas B. Shepard	

MICHIGAN

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	6520 Mercantile Way, Suite 5, Lansing, MI 48911	
TELEPHONE:	(517) 377-1608	Eastern Time
NAWDEX CONTACT:	Gary C. Huffman or Stephen P. Blumer	

MINNESOTA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	2280 Woodale Drive, Mounds View, MN 55112	
TELEPHONE:	(612) 783-3100	Central Time
NAWDEX CONTACT:	Allan D. Arntson	

MISSISSIPPI

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	Suite 710, Federal Office Building, 100 West Capitol Street, Jackson, MS 39269	
TELEPHONE:	(601) 965-4600	Central Time
NAWDEX CONTACT:	Fred Morris, III	

MISSOURI

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	1400 Independence Road, Mail Stop 200, Rolla, MO 65401	
TELEPHONE:	(314) 341-0824	Central Time
NAWDEX CONTACT:	Loyd Waite	

MONTANA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	Federal Building, Drawer 10076, 301 South Park Avenue, Helena, MT 59626-0076	
TELEPHONE:	(406) 449-5263	Mountain Time
NAWDEX CONTACT:	Melvin White	

NEBRASKA

ORGANIZATION:	Nebraska, Natural Resources Commission	
ADDRESS:	301 Centennial Mall South, P.O. Box 94876, Lincoln, NE 68509	
TELEPHONE:	(402) 471-2081	Central Time
NAWDEX CONTACT:	Mahendra K. Bansal, Head, Data Bank Section, Natural Resources Information System	

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	Room 406, Federal Building & U.S. Courthouse, 100 Centennial Mall North, Lincoln, NE 68508	
TELEPHONE:	(402) 437-5082	Central Time
NAWDEX CONTACT:	Glenn B. Engel	

NEVADA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	Room 203, 333 West Nye Lane, Carson City, NV 89706	
TELEPHONE:	(702) 887-7600	Pacific Time
NAWDEX CONTACT:	M. Teresa Foglesong	

NEW HAMPSHIRE

(See U.S. Geological Survey Office in Massachusetts)

NEW JERSEY

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: Mountain View Office Park, 810 Bear Tavern Road, Suite 206, West Trenton, NJ 08628
TELEPHONE: (609) 771-3900 Eastern Time
NAWDEX CONTACT: Deloris W. Speight

NEW MEXICO

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 4501 Indian School, N.E., Suite 200, Albuquerque, NM 87110-3929
TELEPHONE: (505) 262-5330 Mountain Time
NAWDEX CONTACT: Jim C. Schafer

NEW YORK

ORGANIZATION: New York State Geological Survey
ADDRESS: Room 3136 CEC, Albany, NY 12230
TELEPHONE: (518) 474-5816 Eastern Time
NAWDEX CONTACT: Robert Fickies

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: P.O. Box 1669, Albany, NY 12201
TELEPHONE: (518) 472-3109 Eastern Time
NAWDEX CONTACT: Lloyd A. Wagner

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 5 Aerial Way, Syosset, NY 11791
TELEPHONE: (516) 938-8830 Eastern Time
NAWDEX CONTACT: George W. Hawkins

NORTH CAROLINA

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 3916 Sunset Ridge Road, Raleigh, NC 27607
TELEPHONE: (919) 571-4014 Eastern Time
NAWDEX CONTACT: Pamilee Breton

LOCATIONS OF NAWDEX ASSISTANCE CENTERS—Continued

NORTH DAKOTA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	821 East Interstate Avenue, Bismarck, ND 58501	
TELEPHONE:	(701) 250-4604	Central Time
NAWDEX CONTACT:	Russell E. Harkness	

OHIO

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	975 West Third Avenue, Columbus, OH 43212	
TELEPHONE:	(614) 469-5553	Eastern Time
NAWDEX CONTACT:	Ann E. Arnett	

OKLAHOMA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	Broadway Executive Park, Building 7, 202 N.W. 66th, Oklahoma City, OK 73102	
TELEPHONE:	(405) 231-4256	Central Time
NAWDEX CONTACT:	John S. Havens	

OREGON

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	10615 S.E. Cherry Blossom Drive, Portland, OR 97216	
TELEPHONE:	(503) 231-2024	Pacific Time
NAWDEX CONTACT:	Suzanne J. Miller	

PENNSYLVANIA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	840 Market Street, Lemoyne, PA 17043	
TELEPHONE:	(717) 782-3851	Eastern Time
NAWDEX CONTACT:	Robert Helm	

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	Great Valley Corporate Center, 111 Great Valley Parkway, Malvern, PA 19355	
TELEPHONE:	(215) 647-9008	Eastern Time
NAWDEX CONTACT:	Cynthia L. Gilliam	

PENNSYLVANIA—Continued

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: Room 2204, Moorhead Federal Building, 1000 Liberty Avenue, Pittsburgh, PA 15222
TELEPHONE: (412) 644-2864 Eastern Time
NAWDEX CONTACT: Greg Wehner

RHODE ISLAND

(See U.S. Geological Survey Office in Massachusetts)

SOUTH CAROLINA

ORGANIZATION: South Carolina Water Resources Commission
ADDRESS: 1201 Main Street, Suite 1100 Capital Center, Columbia, SC 29202
TELEPHONE: (803) 737-0800 Eastern Time
NAWDEX CONTACT: Theresa Greaney

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: Stephenson Center, Suite 129, 720 Gracern Road, Columbia, SC 29210-7651
TELEPHONE: (803) 750-6001 Eastern Time
NAWDEX CONTACT: David E. Bower

SOUTH DAKOTA

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 1608 Mt. View Road, Rapid City, SD 57702
TELEPHONE: (605) 751-1780 Mountain Time
NAWDEX CONTACT: Daniel G. Driscoll

TENNESSEE

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: 810 Broadway, Suite 500, Nashville, TN 37203
TELEPHONE: (615) 736-5424 Central Time
NAWDEX CONTACT: Lori R. Mercer

TEXAS

ORGANIZATION: Texas Natural Resources Information System
ADDRESS: P.O. Box 13231, Austin, TX 78711-3231
TELEPHONE: (512) 463-8402 Central Time
NAWDEX CONTACT: Dr. Charles Palmer

UTAH

ORGANIZATION: Utah Division of Water Rights
ADDRESS: Room 231, 1636 West North Temple, Salt Lake City, UT 84116
TELEPHONE: (801) 533-6071 Mountain Time
NAWDEX CONTACT: James Riley

ORGANIZATION: Center for Water Resources Research
ADDRESS: Utah State University, UMC-82, Logan, UT 84322
TELEPHONE: (801) 750-3155 or 3172 Mountain Time
NAWDEX CONTACT: David G. Tarboton

ORGANIZATION: U.S. Geological Survey, Water Resources Division
ADDRESS: Room 1016, Administration Building, 1745 West 1700 South, Salt Lake City, UT 84104
TELEPHONE: (801) 524-5654 Mountain Time
NAWDEX CONTACT: Pat Fikstad

ORGANIZATION: Earth Science Information Center, U.S. Geological Survey
ADDRESS: 8105 Federal Building, 125 South State Street, Salt Lake City, UT 84138
TELEPHONE: (801) 524-5652 Mountain Time
NAWDEX CONTACT: Wendy R. Hassibe

VERMONT

(See U.S. Geological Survey Office in Massachusetts)

VIRGINIA

ORGANIZATION: Virginia Water Resources Research Center
ADDRESS: Virginia Polytechnic Institute and State University, 617 North Main Street, Blacksburg, VA 24060-3339
TELEPHONE: (703) 231-8033 Eastern Time
NAWDEX CONTACT: T.W. Johnson

VIRGINIA—Continued

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	3600 West Broad Street, Room 606, Richmond, VA 23230	
TELEPHONE:	(804) 771-2427	Eastern Time
NAWDEX CONTACT:	Byron J. Prugh, Jr.	

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	National Water Data Exchange, 421 National Center, Reston, VA 22092	
TELEPHONE:	(703) 648-5663	Eastern Time
NAWDEX CONTACT:	Carol Lewis	

ORGANIZATION:	Earth Science Information Center, U.S. Geological Survey	
ADDRESS:	507 National Center, Room 1C402, Reston, VA 22092	
TELEPHONE:	(703) 648-6045	Eastern Time
NAWDEX CONTACT:	Information Services	

WASHINGTON

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	Suite 600, Pacific Northwest Area, Washington District, 1201 Pacific Avenue, Tacoma, WA 98402	
TELEPHONE:	(206) 593-6510	Pacific Time
NAWDEX CONTACT:	L.A. Fuste	

ORGANIZATION:	Earth Science Information Center, U.S. Geological Survey	
ADDRESS:	678 U.S. Courthouse, West 920 Riverside Avenue, Spokane, WA 99201	
TELEPHONE:	(509) 353-2524	Pacific Time
NAWDEX CONTACT:	Thomas L. Servatius	

WEST VIRGINIA

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	603 Morris Street, Charleston, WV 25301	
TELEPHONE:	(304) 347-5130, 5132	Eastern Time
NAWDEX CONTACT:	Elizabeth Hanna	

WISCONSIN

ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	6417 Normandy Lane, Madison, WI 53719	
TELEPHONE:	(608) 274-3535	Central Time
NAWDEX CONTACT:	Robert Bodoh	

WYOMING

ORGANIZATION:	Wyoming Water Research Center	
ADDRESS:	Wyoming University, P.O. Box 3067, University Station, Laramie, WY 82071	
TELEPHONE:	(307) 766-2143	Mountain Time
NAWDEX CONTACT:	Barry Lawrence	
ORGANIZATION:	U.S. Geological Survey, Water Resources Division	
ADDRESS:	2617 East Lincoln Way, Suite B, Cheyenne, WY 82001	
TELEPHONE:	(307) 772-2713	Mountain Time
NAWDEX CONTACT:	Sharon L. Green	

Interagency Advisory Committee on Water Data
Annual Subcommittee Report
Fiscal Year 1992

Subcommittee Name: Sedimentation

Chair FY 1992: Richard B. Perry
Agency: National Oceanic and Atmospheric Administration - NOAA
Telephone: (301) 443-8251

Chair FY 1993: Yung-Huang Kuo
Agency: U.S. Army Corps of Engineers
Telephone: (202) 272-8507

Accomplishments during the Year:

The Subcommittee met five times during FY 1992. Four of the meetings were at the Department of Transportation Nassif Building in Washington, D.C., on October 2 and December 11, 1991 and on February 5 and June 10, 1992. The Subcommittee also met with its Technical Committee on April 15, 1992 at the Geological Survey's Hydrologic Instrumentation Facility at the Stennis Space Center in Bay St. Louis, Miss. The Technical Committee provides guidance for the Federal Interagency Sedimentation Project (FISP). The Technical Committee is composed of representatives from those agencies which provide funding for the Project, and many of the Technical Committee members also represent their agencies on the parent Subcommittee. The Technical Committee met twice in FY 1992. The first was in Minneapolis on October 29 and 30, 1991 at the Project. The second was the combined meeting with the Subcommittee in Bay St. Louis on April 14 and 15, 1992. The Technical Committee Chairman in FY 1992 was James L. Fogg of the Bureau of Land Management in Denver, and the Secretary was Ronald R. Copeland of the U.S. Army Corps of Engineers Waterways Experiment Station in Vicksburg, Miss.

Much of the Subcommittee and the Technical Committee activities this year were related to major changes in the location of the Project (FISP), which was established in 1939 to standardize methods of sediment collection and analysis. The Project not only conducts research and development, but also develops, calibrates, and sells sediment sampling equipment. For many years the Project, under the leadership of John Skinner, has been located at the St. Anthony Falls Hydraulic Laboratory of the University of Minnesota in Minneapolis, Minn. The principal funding and operating agencies have been the Geological Survey and the Army Corps of Engineers. Other recent funding agencies for the Project include the Agricultural Research Service, the Bureau of Reclamation, the Forest Service, the Bureau of Land Management, the Federal Highway Administration, and the Tennessee Valley Authority.

Problems developed in the support for the Project from the Corps of Engineers, which necessitated finding a new location. The Technical Committee considered a number of alternatives and recommended that the Project by relocated to the Corps of Engineers Waterways Experiment Station in Vicksburg, Miss. This was endorsed by the parent Subcommittee and the transfer was scheduled for FY 1992. A problem developed when it was determined that the Corps was not authorized to make sales of equipment to foreign governments and private organizations (many of the sales are to Canada). After a number of meetings, the Tennessee Valley Authority has generously offered its services to assume responsibility for all procurement and sales for the Project. The TVA is not bound by the same restrictions regarding foreign sales. All technical functions of the Project will remain with the Corps of Engineers at Vicksburg, and they will warehouse all Project equipment. Control measures will be developed between the TVA and the Corps to

assure inventory control. A Memorandum of Understanding will be developed to specify the role of the various agencies in conducting the affairs of the Project. The Technical Committee is working on a 10-year plan for the technical direction of the Project.

A work group of the Subcommittee was one of the sponsors of the "Bilateral Workshop on Understanding Sedimentation Processes and Model Evaluation," which was organized by the National Research Council in cooperation with the Federal Energy Regulatory Commission (FERC). Dr. Shou-shan Fan of FERC was the principal organizer of the workshop, which was held December 16-18, 1991 at the National Research Council Georgetown Facility in Washington, D.C. It was organized as part of a 5-year scientific and technical agreement between the U.S. and Taiwan. Under the agreement, Taiwan engineers will make an impartial, third party testing and assessment of selected American computer sedimentation models. A report on the results of the workshop is available.

Planning began for the Sixth Federal Interagency Sedimentation Conference to be held in 1996. A site selection committee was formed. Chairman G. Douglas Glysson sent out a request for proposals to various hotels and convention centers/chambers of commerce. The site selection committee is narrowing the probable site to several western cities and final selection will be made next year.

The Notes of Sedimentation Activities for CY 1991 has been compiled and is in press. It covers the major sedimentation activities of the members of the Subcommittee, organized by river basins.

The 1981-1985 Five Year Summary of Reservoir Sedimentation Surveys has been sent to the printer, and is undergoing final editing. This Summary provides a mechanism to assess long-term changes in the capacity of reservoirs due to sediment accumulation. It has been compiled on the appropriate forms by typewriter or word processor in the past. Consideration is being given to the best way to compile the data for the 1986-1990 Summary. This includes the possible development of a computerized data base, starting with data on file with the Soil Conservation Service. It may be possible to use software developed for somewhat similar Geological Survey data bases.

The Subcommittee assisted in planning for the 1993 International Conference on Hydro-Science and Engineering, which is to be held in Washington, D.C. Subcommittee member Robert Joyce of the TVA volunteered to organize a session related to the interests of the Subcommittee. The principal organizer is Dr. Sam Wang of the University of Mississippi.

Reports Published

Notes on Sedimentation Activities, CY 1991, in press.

Five Year Summary of Reservoir Sedimentation Surveys, 1981-1985, being edited.

Report of the Workshop on Understanding Sedimentation Processes and Model Evaluation, December 16-18, 1991: Edited by Shou-shan Fan and Ben C. Yen, Printed by Federal Energy Regulatory Commission, 1992, 213 pp.

Action Plans for Coming Year

The Subcommittee plans to meet six times in the coming year, including a joint meeting with the Technical Committee in Knoxville, Tenn., in October. The Technical Committee plans two meetings during the coming year.

On the transfer of the Federal Interagency Sedimentation project from Minneapolis, Minn., to Vicksburg, Miss., the Subcommittee anticipates the Waterways Experiment Station, Corps of Engineers, to resume full operation of the Project by early FY 1993. The TVA in Knoxville, Tenn., is expected to assist in equipment procurement and sales.

Notes on Sedimentation Activities for CY 1992 will be published and distributed to participating agencies.

The Subcommittee and several of its members will be involved and participate in the 1993 International Conference on Hydro-Science and Engineering to be held June 7-11, 1993 in Washington, D.C.

Planning for the Sixth Federal Interagency Sedimentation Conference (May 1996) will continue. The Conference site will be selected based upon site selection committee findings. The Conference committees will be set up and assigned specific organizing duties.

Computer sedimentation model evaluation by the Interagency Sedimentation Work Group (composed of nine agencies) will continue its third and last phase to develop guidelines on model selection and use. A second interim workshop on understanding sedimentation and model evaluation is planned for 1993 in San Francisco, Calif. This project is scheduled to be completed in 1994.

The 1981-1985 Five Year Summary of Reservoir Sedimentation Surveys (delayed from last year) will be published and distributed. Compilation of the 1986-1990 version probably will be in the same format. Continued discussions on the data base of the surveyed sediment data, and the development of new software, are planned.

Recommendations

It is recommended that the Office of Water Data Coordination lend assistance through computer programs in the establishment of a data base to compile information on reservoir sedimentation surveys.

NEW ENGLAND REGION

GEOLOGICAL SURVEY

St. John Subregion

1. Suspended-sediment data are being collected bimonthly at St. John River near Van Buren, ME, as a part of the National Stream Quality Accounting Network (NASQAN).

Penobscot Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Penobscot River at Eddington, ME, as a part of NASQAN.

Kennebec Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Kennebec River near North Sidney, ME, as a part of NASQAN.

Androscoggin Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Androscoggin River at Brunswick, ME, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Wild River at Gilead, ME, as a part of the National Hydrologic Benchmark Network.

Maine Coastal Subregion

1. Suspended-sediment data are being collected on a quarterly basis at St. Croix River at Milltown, ME.

Saco Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Saco River at Cornish, ME, and on a bimonthly basis at Presumpscot River near West Falmouth, ME, as a part of NASQAN.

Connecticut Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Connecticut River at North Walpole, NH, and at Connecticut River at Thompsonville, CT, as a part of NASQAN.

Massachusetts-Rhode Island Coastal Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Merrimack River above Lowell, MA, at the Charles River at Dover, MA, and at Blackstone River at Millville, MA, as part of the NASQAN program.

2. Suspended-sediment data are being collected on a quarterly basis at Pawcatuck River at Westerly, RI, Blackstone River at Manville, RI, Pawtuxet River at Pawtuxet, RI, and Blackstone River at Millville, MA, as a part of NASQAN.

Connecticut Coastal Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Housatonic River at Stevenson, CT, and quarterly at Shetucket River at South Windham, CT, as a part of NASQAN.

St. Francois Subregion

1. Suspended-sediment data are being collected on a biweekly basis at Black River at Coventry, VT, as part of NASQAN.

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

District Chief, WRD
U.S. Geological Survey
28 Lord Road, Suite 280
Marlborough, MA 01752

District Chief, WRD
U.S. Geological Survey
450 Main Street, Room 525
Hartford, CT 06103

District Chief, WRD
U.S. Geological Survey
26 Ganneston Drive
Augusta, ME 04330

District Chief, WRD
U.S. Geological Survey
New Hampshire/Vermont District
525 Clinton Street
Bow, NH 03304

SOIL CONSERVATION SERVICE

1. Special Studies

A special bedload sediment transport and channel stability study was conducted on Ball Mountain Brook, a tributary to West River and Connecticut River in Vermont

MID ATLANTIC REGION

CORPS OF ENGINEERS

North Atlantic Division

Baltimore District

Sedimentation Surveys.

1. Reservoirs. A sedimentation survey of Jennings Randolph Lake, Maryland and West Virginia, was performed to determine the average annual sedimentation rate within the reservoir. This reconnaissance level study estimated that the average basin yield is 0.23 to 0.50 acre-feet per square mile per year, or approximately three to five times the pre-project estimate. The relatively high yield is due to the extremely high rates of production during flood events, as opposed to very low rates of sediment production during normal flows. Conclusions were based on the results of measured deposition within the reservoir, sediment transport rates (measured and computed) upstream of the reservoir, and the application of several analytical and empirical yield estimating methods.

2. Harbor and Channels. Hydrographic condition, before dredge, and after dredge surveys were conducted for the harbor and channel projects listed in the following to determine controlling depths in navigable waterways, the need for dredging, and the quantities of material dredged. Surveys of the projects or reaches were conducted across the full channel widths at 100-foot intervals. The controlling depth surveys were published periodically and included summaries of the minimum channel depths in each quarter width of channel for each channel reach.

PROJECT	NUMBER OF SURVEYS
Baltimore Harbor & Channels	31
Anacostia River	2
Chester River	1
Bonum Creek	2
Wicomico River	2
Big Thorofare	2
Nanticoke River	2
Point Lookout	1
Twitch Cove	2
Ocean City	2
Sinepuxent Bay	1
Knapps Narrows	2
Isle of Wight Bay	1
Fishing Bay	1
Crisfield Harbor	1
Herring Bay and Rockhold Creek	1
Honga River	1
Lower Thorofare	1
Madison Bay	1
Monroe Bay	1
Mt. Vernon (Potomac River)	1

PROJECT	NUMBER OF SURVEYS
Nan Cove	1
Nanticoke River	1
Pocomoke River	1
Queenstown Harbor	1
St. Peters Creek	1
St. Jerome Creek	1
St. Georges Creek	1
Tyaskin Creek	1
Upper Machodoc	1
Warwich River	1
Nomini Bay and Creek	1

New York District

The District conducted sediment tests at the following locations.

Project Name	Grain Size	Bulk Sediment	Elutriate	Bioassay	Bioaccumulation	E.P. Toxicity
New York Harbor						
- Pierhead Channel	X	X	X	X	X	-
Bayridge & Red Hook Channels						
- Cowanus, Main & Br	X	X	X	X	X	-
NY & NJ Channels						
- Perth Amboy Anchorage	X	X	-	-	X	-
- Secondary Channel	X	X	X	X	X	-
Gowanus Creek	X	X	X	X	X	-
Raritan River						
- Mile 0-2	X	X	X	X	X	-
- Mile 2-4	X	X	X	X	X	-
Coney Island	X	-	-	-	-	-

Norfolk District

Sedimentation Surveys. Lake Moomaw. A sediment survey was conducted at Lake Moomaw in June 1992. The anticipated completion date of the Sedimentation Report is the third quarter of FY 1993. The survey was a part of the project monitoring program that compares elevations from 1978, before filling was initiated, 10 years after filling was completed. A complete survey of all established reservoir and downstream ranges was performed. The reservoir ranges were measured with echo-sounders and downstream ranges were measured using conventional survey methods. The results of the survey indicate that an insignificant amount of sedimentation has occurred over the previous ten year

interval and that the next survey should be scheduled ten years from this resurvey.

Philadelphia District

Sedimentation Survey. A sedimentation survey was performed at F.E. Walter Reservoir in CY 92. Hydrographic surveys were obtained at previously established range lines. The sedimentation analysis will be performed in CY 93.

MID-ATLANTIC REGION

GEOLOGICAL SURVEY

Richelieu Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Richelieu River (Lake Champlain) at Rouses Point, NY, as a part of the National Stream Quality Accounting Network (NASQAN).

Upper Hudson Subregion

1. Suspended-sediment data are being collected on a daily basis at Hudson River at Stillwater, NY, and Hudson River at Waterford, NY, in cooperation with the New York State Department of Environmental Conservation. Suspended-sediment data are being collected on a periodic basis at Hudson River at Rogers Island at Fort Edward, NY, and Hudson River at Schuylerville, NY, and Hudson River near Fort Miller, NY.

2. Suspended-sediment data are being collected on a quarterly basis at Hudson River at Green Island, NY, as a part of NASQAN.

3. Suspended-sediment data are being collected on a quarterly basis at Esopus Creek at Shandaken, NY, as a part of the National Hydrologic Benchmark Network.

4. Suspended-sediment data are being collected five times a year at Wallkill River near Sussex, NJ, Papakating Creek at Sussex, NJ, Wallkill River near Unionville, NY, and Black Creek near Vernon, NJ.

Lower Hudson-Long Island Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Passaic River at Little Falls, NJ, and quarterly at Raritan River at Queens Bridge at Bound Brook, NJ, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Nissequoque River near Smithtown, NY, and Carmans River at Yaphank, NY, as part of NASQAN.

3. Suspended-sediment data are being collected five times a year at Hackensack River at Riverdale, NJ, Passaic River near Millington, NJ, Passaic River near Chatham, NJ, Rockaway River above reservoir at Boonton, NJ, Rockaway River at Pine Brook, NJ, Whippany River near Pine Brook, NJ, Passaic River at Two Bridges, NJ, Pequannock River at Macopin Intake Dam, NJ, Ramapo River near Mahwah, NJ, Pompton River at Packanack Lake, NJ, Passaic River at Route 46 at Elmwood Park, NJ, Saddle River at Lodi, NJ, Rahway River near Springfield, NJ, Rahway River at Rahway, NJ, South Branch Raritan River at Middle Valley, NJ, South Branch-Raritan River, Arch Street at High Bridge, NJ, Spruce Run near Glen Gardner, NJ, Mulhockaway Creek at Van Syckel, NJ, South Branch Raritan River at Stanton, NJ, South Branch Raritan River at Three Bridges, NJ, Neshanick River at Reaville, NJ, North Branch Raritan River near Chester, NJ, North Branch Raritan River at Burnt Mills, NJ, Lamington (Black) River near Pottersville, NJ, Rockaway Creek at Whitehouse, NJ, Lamington River at Burnt Mills, NJ, Raritan River at Manville, NJ, Millstone River near Manalapan, NJ, Millstone River at Grovers Mill, NJ, Stony Brook at Princeton, NJ, Beden Brook near Rocky Hill, NJ, Millstone River at Blackwells Mills, NJ, Matchaponix Brook at Mundy Ave., at Spotswood, NJ, Manalapan Brook at Federal Road near Manalapan, NJ, in cooperation with the New Jersey Department of Environmental Protection and Energy.

Delaware Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Toms River near Toms River, NJ, Maurice River at Norma, NJ, and West Branch Wading River at Maxwell, NJ, and on a quarterly basis at Delaware River at Trenton, NJ, as a part of NASQAN.

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

3. Bottom material data (carbon, metals, organochlorine pesticides) are being collected at about 16 subregion sites in New Jersey on a yearly schedule.

4. Suspended-sediment data are being collected five times a year at Manasquan River at Squankum, NJ, Mullica River near Atco, NJ, Mullica River at outlet of Atsion Lake at Atsion, NJ, Hayes Mill Creek at Atco, NJ, Hayes Mill Creek near Chesilhurst, NJ, Sleeper Branch near Atsion, NJ, Clark Branch near Atsion, NJ, Pump Branch near Waterford Works, NJ, Blue Anchor Brook at Elm, NJ, Albertson Branch near Elm, NJ, Batsto River at Batsto, NJ, West Branch Wading River at Maxwell, NJ, Oswego River at Harrisville, NJ, East Branch Bass River near New Gretna, NJ, Great Egg Harbor River near Sicklerville, NJ, Great Egg Harbor River at Folsom, NJ, Great Egg Harbor River at Weymouth, NJ, Maurice River near Millville, NJ, Delaware River at Montague, NJ, Delaware River at Portland, PA, Paulins Kill at Balesville, NJ, Paulins Kill at Blairstown, NJ, Pequest River at Pequest, NJ, Delaware River at Northampton Street at Easton, PA, Pohatcong Creek at New Village, NJ, Musconetcong River at Lockwood, NJ, Musconetcong River near Bloomsbury, NJ, Musconetcong River near Riegelsville, NJ, Delaware River at Riegelsville, NJ, Delaware River at Lumberville, PA, Assunpink Creek near Clarksville, NJ, Assunpink Creek at Trenton, NJ, Crosswicks Creek at Extonville, NJ, Doctors Creek at Allentown, NJ, South Branch Rancocas Creek at Vincentown, NJ, North Branch Rancocas Creek at Pemberton, NJ, North Branch Pennsauken Creek near Moorestown, NJ, South Branch Pennsauken Creek at Cherry Hill, NJ, Cooper River at Haddonfield, NJ, South Branch Big Timber Creek at Blackwood Terrace, NJ, Raccoon Creek near Swedesboro, NJ, Oldmans Creek at Porches Mill, NJ, Salem River at Woodstown, NJ, in cooperation with the New Jersey Department of Environmental Protection and Energy.

Susquehanna Subregion

1. As a part of the NASQAN and Hydrologic Benchmark programs, suspended-sediment data are being collected on a bimonthly basis at Raystown Branch Juniata River at Saxton and Susquehanna River at Harrisburg, and on a quarterly basis at Susquehanna River at Danville, West Branch Susquehanna River at Lewisburg, and Young Womans Creek near Renovo. In addition, four samples were collected during high-flow events at the Susquehanna River at Harrisburg as part of the NASQAN program.

2. Daily 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 bimonthly basis at Susquehanna River at Conowingo, MD, as a part of NASQAN and on a daily basis, beginning July 1984, as part of the Chesapeake Bay River-Input Monitoring project.

Upper Chesapeake Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Choptank River near Greensboro, MD, as part of NASQAN, and on a monthly basis and for storm events as part of the Chesapeake Bay River-Input Monitoring project.

2. Suspended-sediment data are being collected on a bimonthly basis at Patuxent River near Bowie, MD, as a part of NASQAN, and on a monthly basis and for storm events as part of the Chesapeake Bay River-Input Monitoring project.

Potomac Subregion

1. Suspended-sediment data are being collected on a daily basis at Monocacy River at Reichs Ford Bridge near Frederick, MD, as part of the Federal CBR program.

2. Suspended-sediment data are being collected on a daily basis 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 bimonthly basis at Potomac River at Chain Bridge, Washington, D.C., and five times a year at Potomac River at Shepherdstown, WV, and Shenandoah River at Millville, WV, as a part of NASQAN.

4. Suspended-sediment data are being collected on a daily basis at Monocacy River at Bridgeport, MD, in cooperation with the Interstate Commission on the Potomac River basin as part of a study looking at nutrient loadings.

Lower Chesapeake Subregion

1. Suspended-sediment data are being collected on a twice-weekly basis and during storm events at Rappahannock River at Remington, VA, as a part of the Federal CBR program.

2. Suspended-sediment data are being collected bimonthly at Rappahannock River near Fredericksburg, VA, Mattaponi River near Beulahville, VA, Pamunkey River near Hanover, VA, Appomattox River at Matoaca, VA, and James River at Cartersville, VA, as part of NASQAN.

3. Suspended-sediment data are being collected quarterly at Holiday Creek near Andersonville, VA, as part of the National Hydrologic Benchmark Network.

4. Suspended-solids data are being collected on a twice-weekly basis and during storm events at Rappahannock River near Fredricksburg, James River at Cartersville, VA, Pamunkey River near Hanover, VA, Mattaponi River near Beulahville, VA, and Appomattox River at Matoaca, VA, in cooperation with the Virginia Water Control Board.

Special Studies

1. Stormflow suspended-sediment data are being collected at three sites on a drainage channel at a U.S. Navy facility near Mechanicsburg, PA. The project has been designed to quantify the discharge of potentially-contaminated sediment at Trindle Spring Run and to the karst ground-water system. Approximately 90 percent of the samples are collected by automatic samplers, and the remaining 10 percent are collected manually.

2. As part of the NAWQA program, bottom-material samples were collected at Conowingo Reservoir, Conestoga River near Safe Harbor, PA, East Branch Octoraro Creek near Kirkwood, PA, Big Beaver Creek near Refton, PA, Swatara Creek at Hershey, PA, Quittapahilla Creek near Palmyra, PA, Codorus Creek near Pleasureville, PA, Deer Creek at Gorsuch Mills, PA, Mill Creek near Lancaster, PA, Frankstown Branch Juniata River near Holidaysburg, PA, Kishacoquillas Creek at Lewistown, PA, Mahoney Creek near Gowen City, PA, West Mahantango Creek near Liverpool, PA, Penns Creek at Spring Mills, PA, Juniata River at Newport, PA, Susquehanna River at Danville, PA, and West Branch Susquehanna River at Lewisburg, PA. Particle-size analysis was performed on all samples, and the silt-clay-sized fractions were analyzed for selected trace elements and organic compounds.

3. Suspended-sediment data are being collected during base and storm flows at Little Conestoga Creek near Churchtown, PA, Pequea Creek at Martic Forge, PA, and Mill Creek near Lyndon, PA, as part of a study to assess loads of pesticides transported by these streams.

4. Suspended-sediment data are being collected during base and storm flows at five sites within the Paxton Creek watershed, PA, as part of a study to assess effects of stormflow runoff on water quality.

5. Suspended-solids data are being collected on a twice-weekly basis and during storm events at Rappahannock River near Fredricksburg, VA, Mattaponi River near Beulahville, VA, Pamunkey River near Hanover, VA, James River at Cartersville, VA, and Appomattox River at Matoaca, VA, in cooperation with the Virginia Water Control Board. These data are being used to improve the understanding of input of suspended solids into Chesapeake Bay.

6. Samples of fine-grained streambed sediment were collected at 22 stream sites throughout the Potomac River basin for analysis for organochlorine pesticides, semi-volatile organic compounds, PCB's and trace metals. The samples, collected under the auspices of the National Water-Quality Assessment program, were part of a basinwide contaminant survey that included samples of clam and fish tissues at the same 22 sites.

7. Suspended-sediment data are being collected at six sites within the Patuxent watershed as part of a cooperative study of non-point source loading with the Maryland Department of the Environment. Data include both monthly baseflow samples and high-flow samples taken throughout the year.

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

District Chief, WRD
U.S. Geological Survey
208 Carroll Building
8600 LaSalle Road
Towson, MD 21286

District Chief, WRD
U.S. Geological Survey
810 Bears Tavern Road
Suite 206
West Trenton, NJ 08628

District Chief, WRD
U.S. Geological Survey
840 Market Street
Lemoyne, PA 17043-1586

District Chief, WRD
U.S. Geological Survey
P.O. Box 1669
Albany, NY 12201

District Chief, WRD
U.S. Geological Survey
603 Morris Street
Charleston, WV 25301

District Chief, WRD
U.S. Geological Survey
3600 West Broad Street, Room 606
Richmond, VA 23230

MID-ATLANTIC (02) REGION

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities.

a. Public Law 534

Major Drainage	Watershed	Stream	County	State
Potomac	Christians Cr.	Christians Cr.	Augusta	VA

b. Public Law-566

Major Drainage	Watershed	Stream	County	State
Pequest River			Sussex	NJ
Delaware River	Christiana R.		New Castle	DE
West Branch of Susquehanna R.	Sinnemahoning Creek Driftwood Br. Sinnema. Ck. West Creek	Sinnemahoning Portage Creek	Cameron	PA
Schuylkill R.	Tulpehocken Cr.	Tulpehocken Creek	Berks, Lebanon	PA

2. Reservoir Sedimentation Surveys

Reservoir sedimentation surveys were made in the following reservoir:

Reservoir	County	State
Stoney Brook #11A (Amwell Lake)	Hunterdon	NJ

3. Special Studies

A statewide estimate of erosion and sediment yield was conducted in Virginia within 491 hydrologic units or watersheds using GIS data layers in cooperation with the Virginia Division of Soil and Water as part of a Non-point Source Pollution Targeting Project.

SOUTH ATLANTIC-GULF REGION

CORPS OF ENGINEERS

South Atlantic Division

Charleston District

Coastal Shoreline Monitoring. Monitoring of coastal shoreline changes for dual jetty systems at Little River and Murrells Inlets, South Carolina continued through 1992. Maintenance dredging at Murrells Inlet and placement of the dredged material along the beach front at North Litchfield Beach, Hunting Beach State Park, and south Garden City was completed in May 1988. This was the first and only maintenance dredging effort to take place at the inlet since the dual jetty system was completed. Maintenance dredging at Little River Inlet and placement of dredged material adjacent to the west jetty, west of the west jetty and east of the east jetty was completed in January 1984. This was the first and only maintenance dredging effort to take place at this inlet since the dual jetty system was completed. The Coastal Engineering Research Center (CERC) conducted an analysis of the monitoring data collected at Little River Inlet between 1979 and 1989. This analysis included beach profile analyses; computations of shoal and fillet volumes; a pre- and post-project refraction analysis using RCPWAVE; examination of aerial photography; and a brief review of historical shoreline change maps. CERC's final report which was entitled "Coastal Response to a Dual Jetty System at Little River Inlet, North and South Carolina" was published in March 1992. The monitoring of the projects is being performed to determine the effects that a dual jetty system has on littoral transport processes and adjacent shorelines. Annual data being collected for monitoring these projects include:

a. Aerial photography
b. Beach profiles upcoast and downcoast of the jetties
c. Hydrographic surveys of the inlet area
d. Structural performance

The data, collected by the District, is forwarded to CERC at US Army Engineers Waterways Experiment Station in Vicksburg, Mississippi, for analysis and report preparation. In FY 91, CERC and the District conducted current velocity measurements at various locations within Little River Inlet during ebb and flood tidal conditions. These current velocity measurements along with data obtained from model studies conducted prior to the project's construction and bathymetric surveys within the inlet were used by CERC to analyze the thalweg which is located adjacent to the downcoast jetty. Anticipated date for the final CERC report covering the thalweg status at the Little River Inlet is FY 93. In addition to the above monitoring of the two dual jetty systems, monitoring of the storm surge protection projects for Folly Beach and Myrtle Beach, South Carolina, has been initiated. Beach survey profiles for Folly Beach were taken in FY 89 and September 1992; and beach survey profiles for Myrtle Beach were taken in FY 91. Also controlled orthographic maps were made for the Folly Beach Project from aerial photographs which were taken in October 1990 and December 1992. These maps will be used to monitor project-related changes to adjacent coastal areas and project related changes to topography and bathymetry within Stono Inlet. The

project is scheduled to be completed on or before 15 May 1993. After the project is completed, monitoring surveys (beach survey profiles) will be taken every four months for the first year after construction and every six months for the next two years. In addition to the beach profile surveys, controlled orthographic maps will be made from aerial photographs which will be taken annually for the first three years after construction. The Myrtle Beach Storm Surge Protection Project's General Design Memorandum, currently being printed, used controlled orthographic maps which were made from aerial photographs taken in September 1991.

Cooper River Rediversion Project. The post-construction monitoring of the entrance, intake, and tailrace canals was begun following completion of the Cooper River Rediversion Project in 1985. The monitoring consists of the hydrographic and topographic surveys of 114 cross sections across the canal plus seven cross sections across the Santee River. The monitoring is to be done annually unless conditions warrant otherwise. Following the initial start-up of the powerhouse in 1985, a scour hole developed immediately off the end of the tailrace stilling basin. Emergency measures were taken to repair the scour hole by dewatering a portion of the tailrace canal, filling the scour hole with soil to elevation -5 NGVD, and then placing a five-foot layer of riprap across the channel bottom. Upon completion of this repair, another scour hole formed downstream of the initial hole. Plans and specifications were prepared during 1988 and work was completed in 1989 to armor the channel bottom within the secondary scour hole with riprap. Hydrographic surveys of this area were taken every three months to monitor the condition of the area. As a result of the 1990 monitoring surveys, a determination was made to reduce the frequency of the monitoring to a semi-annual cycle. A review of the 1992 surveys indicates that the secondary scour hole has stabilized. However, channel scouring downstream is increasing, and the semi-annual monitoring surveys will continue until the secondary hole is stable.

Bank-to-bank cross sections are also being taken at approximate 1,000-foot intervals in Charleston Harbor (Cooper River) from Fort Sumter to Snow Point. These sections are being used to monitor sediment movement in the harbor as a result of the reduced freshwater releases into the river from Lake Moultrie. These cross sections should reveal any sloughing of navigation channel banks and will aid in determining effects on sedimentation deposits outside of the navigation channel. These surveys will also be used as a basis for predicting the volume of future maintenance dredging, because in addition to the Rediversion Project, the deepening of the harbor was completed in 1992. This deepening along with the Rediversion Project may cause changes in historical shoaling patterns. These bank-to-bank cross sections are to be taken annually for a ten-year period or until the navigation channel stabilizes. The eighth set of these cross sections was taken during 1992.

Mobile District

Sediment Load Measurements. Daily suspended sediment samples were collected at Amory, Mississippi until 30 September 1992.

The ongoing program of collecting suspended samples includes periodic sampling at 39 stations. Thirty-two of these stations are operated by the U.S. Geological Survey at the following locations:

Alabama	Alabama River nr Montgomery, AL Alabama River at Claiborne, AL Alabama River nr Catherine, AL Alabama River nr Midway, AL Alabama River at Selma, AL Black Warrior River at Northport, AL Cahaba River nr Suttle, AL Tombigbee River nr Nanafalia, AL Tombigbee River nr Pickensville, AL Tombigbee River nr Cochrane, AL Tombigbee River at Gainesville, AL* Tombigbee River nr Jackson, AL
	*Removed 30 September 1992
Florida	Apalachicola River at Chattahoochee, FL Apalachicola River at Sumatra, FL
Georgia	Chattahoochee River nr Cornelia, GA Chattahoochee River nr Whitesburg, GA Chestatee River nr Dahlonega, GA Flint River at Newton, GA Oostanaula River at Resaca, GA
Mississippi	Buttahatchee River nr Aberdeen, MS Luxapallila Creek nr Columbus, MS Mantachie Creek below Dorsey, MS Noxubee River at Macon, MS Tombigbee River nr Marietta, MS Tombigbee River nr Fulton, MS Tombigbee River at Bigbee, MS Tombigbee River nr Amory, MS Tombigbee River at Aberdeen, MS Tombigbee River nr Columbus, MS Town Creek nr Nettleton, MS Twentymile Creek nr Guntown, MS Twentymile Creek nr Mantachie, MS

Bed material samples were collected at numerous study sites and gaging stations within the Mobile District. Grain size analyses were utilized in bed load computations, stability analysis, and environmental studies for the various streams.

Equipment used to obtain suspended sediment or bed material samples was the DH-48, DH-59, D-74, P-61, BMH-53, BM-54, and BMH-60.

Sedimentation Surveys. Sedimentation range re-surveys were completed on Carters Reregulation Lake (October 1992) and Okatibbee Lake (November 1992). Results from the Carters Reregulation Lake re-survey show moderate aggradation in the old Coosawattee River channel and the old Talking Rock Creek channel, with minimal aggradation elsewhere. The Okatibbee Lake re-survey revealed moderate aggradation in the upper end of the lake and minimal aggradation near the dam.

Other Investigations.

1. Tennessee-Tombigbee Waterway Bendway Management Study. The collection of suspended and bed load samples to define the sedimentological processes in the bendways continued periodically throughout the year.

2. Apalachicola, Chattahoochee, and Flint River Basin. River flows and suspended sediment loads continued to be monitored at seven locations in compliance with the "Apalachicola, Chattahoochee and Flint Rivers Navigational Maintenance Plan."

3. Jim Woodruff Lock and Dam Tail Water Cross-Current Flow Study. Collected current data downstream from Jim Woodruff Lock and Dam on the Apalachicola River. The purpose of the study was to determine alternatives to eliminate the difficulties to navigation interests caused by the currents in the lower lock approach on the right bank. The cross-currents are created by the development of a large gravel bar near the left bank and immediately downstream from the powerhouse discharge structure. In addition, the resultant data is being used by the U.S. Fish and Wildlife Service in studying the Gulf Sturgeon, an endangered species.

Savannah District

Dredging Surveys.

1. District performed examination and before- and after-dredging surveys in Savannah and Brunswick Harbors, the Atlantic Intracoastal Waterway (AIWW) between Hilton Head, South Carolina and Fernandina Beach, Florida and in Cumberland Sound and Kings Bay for the Kings Bay Naval Submarine Base.

2. An annual survey of both Savannah and Brunswick Harbors was performed and published in 1992. These surveys are bank-to-bank hydrographic surveys of all the Federally authorized channels for that project.

3. Following is a summary of the project condition surveys performed during 1992:

Project	No. of Surveys
Savannah Harbor	11
Brunswick Harbor	12
AIWW	3
Savannah River Below Augusta (SRBA)	1

These surveys summarize the minimum depths in each channel quarter of a specific reach in Savannah and Brunswick Harbors. In the AIWW and SRBA, condition surveys summarize minimum depths in specified reaches along the channel centerline. Three condition surveys of Kings Bay were published. This work was performed for the Base Public Works Office and consist of bank-to-bank hydrographic surveys run at 500- and 250-foot intervals.

4. Between April and December 1992, five profile surveys in Back River, Savannah Harbor were performed to determine the impacts closing New Cut and

taking the Tide Gate out of operation has on scouring sediment from Back River. The results of analyzing these surveys will be included in the Long-Term Management Study for Savannah Harbor which is being initiated in FY 93.

Wilmington District

Inlet Sedimentation

1. Masonboro Inlet.

a. Purpose. To determine the rate and extent of shoaling between the jetties and in the sound areas behind the inlet and to determine sound bypassing requirements.

b. Type of Survey. Hydrographic.

c. Elements Measured. Depths in the inlet and beach profiles.

d. Survey Scope. Complete hydrographic surveys are made of the inlet between the jetties and Banks Channel, Shinn Creek, and Masonboro Channel. In addition, surveys are made of the adjacent beaches, Wrightsville Beach and Masonboro Island, to determine impacts of the jetties on the stability of the shorelines and regulate sand bypassing requirements.

e. Surveys of the inlet are made at 6-month intervals whereas beach surveys are made annually.

f. A spit at the south end of Wrightsville Beach has formed and continues to grow by trapping the sand which is allowed to enter the Masonboro Inlet Navigation project for sand bypassing purposes.

In 1966, the north jetty at Masonboro Inlet was constructed with a weir to allow sand to enter the inlet. The navigation channel moved adjacent to the jetty due to the one sided sheltering effect of the single jetty. There was no spit at the south end of Wrightsville Beach.

In 1980, the south jetty was constructed. The sheltering effect provided by the south jetty allowed approximately half of the sand crossing the weir to form a spit. (137,000 cu. yds./yr of 298,000 cu. yds./yr or 46 percent). The formation of the spit recreates land that was originally platted and is privately owned. The private ownership prevents the spit from being dredged and the sand bypassed to the adjacent islands.

The formation of the spit created several problems.

(1) The navigation channel has been "pushed" along the south jetty. This causes misalignment of the navigation channel and creates the potential for jetty foundation problems. It was similar problems with the channel being "pushed" along the north jetty that required the south jetty to be constructed.

(2) The south jetty has been flanked. The end of the south jetty is no longer connected to Masonboro Island. While there is no immediate danger

to the structure, problems could develop if left uncorrected.

(3) The sand, which was to be bypassed to Wrightsville Beach and Masonboro Island, has been trapped in the spit and is presently unavailable for bypassing.

The southerly growth of the spit occurs at the rate of about 100 feet per year. The growth of the spit may be storm related. Under normal conditions, the growth of the spit seems to checked by the scour effect of the navigation channel, and the spit assumes a wide rounded shape. During storms, the exposed side of the spit becomes flattened by the waves and currents. The spit narrows and becomes elongated. These conditions move the navigation channel to the south side of the inlet and the north end of Masonboro Island is eroded. When normal conditions are re-established, the elongated spit maintains its length and grows again by becoming wide and rounded. The growth has been constant and shows no signs of change. However, its interaction with the south jetty will have an effect on the spit's growth.

Approximately 800,000 cubic yards of material is contained in the spit between the locations of the 1982 and 1992 shorelines. This material could be used for bypassing assuming the necessary rights of way are obtained.

The borrow area contains 1.3 million cubic yards of material. At the end of the last renourishment, there was approximately 1.0 million cubic yards in the borrow area. Approximately forty percent of the material left after the last dredging is of poor quality, and the remaining sixty percent is in an area where the wave climate slows the dredge's production rate. Some of the 300,000 cubic yards of new material is due to bank sloughing into the dredged area and is not material which has entered over the weir.

There is approximately 250,000 cubic yards of good beach sand, which is easily dredged, presently in the borrow area. There is another 200,000 cubic yards which is good quality beach sand, but it may be more difficult to dredge because of the wave climate.

In June 1992, the project required 23,000 cubic yards of sand. By the next renourishment, it will require 500,000 to 600,000 cubic yards.

The initial steps to have the local sponsor acquire the spit have been taken by the District.

2. Carolina Beach Inlet.

a. Purpose. To monitor the rate of shoaling in a deposition basin constructed in the inlet. The deposition basin is to be used as a source of future beach nourishment material for the Town of Carolina Beach.

b. Type of Survey. Hydrographic.

c. Elements Measured. Depths in the deposition basin and beach profiles.

d. Survey Scope. Hydrographic surveys are made of the deposition

basin and the inlet ocean bar and interior channels. Beach profile surveys are made on Masonboro Island and Carolina Beach. The survey data is used to determine nourishment requirements for Carolina Beach and assess the ability of the deposition basin to trap sufficient quantities of material to satisfy the nourishment requirements.

e. Surveys of the deposition basin and beach profiles are made annually.

f. The deposition basin was dredged in the spring of 1985 with approximately 765,000 cubic yards of material pumped southward to the north end of Carolina Beach. A survey of the deposition basin made in the summer of 1984 indicated that over 555,000 cubic yards of sand had accumulated in the trap. Renourishment of the Carolina Beach project using an expanded deposition basin began on 16 March 1988 and was completed on 27 April 1988. A total of 950,000 cubic yards was removed from the trap and placed on the northern 6,000 feet of Carolina Beach. Between April 1988 and April 1990, approximately 445,000 cubic yards of sand was deposited in the deposition basin. The accumulated material was removed during the spring of 1991 and placed on Carolina Beach. A total of 1,008,000 cubic yards was dredged from the trap and distributed along the entire 14,000 lineal feet of the Carolina Beach storm damage reduction project.

The existing inlet borrow area was surveyed in July 1992 to determine an estimate of the total amount of available material. The average annual deposition volume in the borrow area has been measured at about 250,000 cubic yards per year or about 750,000 cubic yards every three year cycle. By adding the existing material and the average annual shoaling volumes, it is estimated that a sufficient volume of material will be available in the inlet borrow area for the remainder of the project life.

3. Oregon Inlet.

a. Purpose. To measure shoaling rates in a dredge maintained navigation channel across the inlet's ocean bar and monitor the response of the adjacent beaches, Bodie Island to the North and Pea Island to the south.

b. Type of Survey. Hydrographic.

c. Elements Measured. Depths in the inlet bar channel and beach profiles.

d. Survey Scope. Hydrographic surveys are made approximately every two weeks in the bar channel, extending from the Bonner Bridge seaward to the 25-foot depth contour. Beach profiles are made along 3 miles of beach both north and south of the inlet every two months.

e. The beach profile surveys were begun in 1983. Due to the relatively short period of record, no conclusions have been reached as to the impact of dredging on the stability of the beaches. However, rapid erosion of the north end of Pea Island has been occurring over the last 3 years with the erosion threatening the Bonner Bridge, U.S. Coast Guard Station, and N.C. Highway 12 on Pea Island. The bar channel surveys indicate rapid channel shoaling particularly following coastal storms. The erosion of the north end

of Pea Island became so severe during a northeast storm of March 1989 that the State of North Carolina constructed a terminal groin on the north tip of the island in order to protect the southern abutment of the bridge and the N.C. Highway 12 approach to the bridge. The groin was completed in March 1991. In April 1991, 300,000 cubic yards of sand was excavated from the portion of the navigation channel that passes beneath the Bonner Bridge. This material was deposited on Pea Island between one and two miles south of the inlet. The channel under the bridge was redredged in September 1991 along with the ocean bar channel with the material also placed on Pea Island. Approximately 96,500 cubic yards of sand was removed from under the bridge while 90,000 cubic yards was dredged from the bar channel.

Reservoir Sedimentation. B. Everett Jordan Project. The first sedimentation resurvey of B. Everett Jordan Lake was finished in the summer of 1990. Preliminary data indicates minor storage losses due to sedimentation coming into Jordan Lake since inception of the project in 1982. A report detailing the field data, and revised storages is nearing completion.

SOUTH ATLANTIC-GULF REGION

GEOLOGICAL SURVEY

Chowan-Roanoke Subregion

1. Suspended-sediment data are collected five times per year at Dan River at Paces, VA, and quarterly at Nottoway River near Sebrell, VA, Meherrin River at Emporia, VA, and Blackwater River near Franklin, VA, as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are collected quarterly at Roanoke River at Roanoke Rapids, NC, as part of NASQAN.

Neuse-Pamlico Subregion

1. Suspended-sediment data are collected bimonthly at Neuse River at Kinston, and Contentnea Creek at Hookerton, NC, and quarterly at Tar River at Tarboro, NC, as a part of NASQAN.

Cape Fear Subregion

1. Suspended-sediment data are collected quarterly on the Cape Fear River at Lock 1 near Kelly, NC, as part of the NASQAN program.

Pee Dee Subregion

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

2. Suspended-sediment data are being collected on a bimonthly basis at Lynches River at Effingham, SC, Black River at Kingstree, SC, Rocky River near Norwood, NC, and at Pee Dee River at Pee Dee, SC, as a part of NASQAN.

3. Suspended-sediment data are being collected daily and more frequently during flood events at the Yadkin River at Yadkin College, NC, as part of the Federal Collection of Basic Records (CBR) program.

4. Suspended-sediment data are being collected on a bimonthly basis at Rocky River near Norwood, NC, as part of NASQAN.

Santee-Edisto Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Edisto River near Givhans, SC, as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at Santee River below St. Stephens, SC. This is being done in cooperation with the COE.

Ogeechee-Savannah Subregion

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

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

Altamaha-St. Marys Subregion

1. Suspended-sediment data are being collected on a quarterly 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 bimonthly basis at Altamaha River near Everett City, GA, and quarterly at Satilla River at Atkinson, GA, as a part of NASQAN.

St. Johns Subregion

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

Southern Florida Subregion

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

Peace-Tampa Bay Subregion

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

Suwannee Subregion

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

Ochlockonee Subregion

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

2. Suspended-sediment data are being collected on a quarterly 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 quarterly basis at two sites in Florida as a part of NASQAN. Suspended-sediment data are being collected periodically at two sites in the Apalachicola River basin in cooperation with the COE.

2. Suspended-sediment data are being collected on a bimonthly basis at Flint River at Newton, GA, and Chattahoochee River near Columbia, AL, as part of NASQAN.

Choctawhatchee-Escambia Subregion

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

Alabama Subregion

1. Suspended-sediment data are being collected 10 times per year at Alabama River near Montgomery, AL, in cooperation with the COE, and bimonthly at Alabama River at Claiborne, AL, and Cahaba River at Centreville, AL, as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis in cooperation with the COE at the following sites:

Alabama River at Selma
Cahaba River near Suttle
Alabama River above Millers Ferry
Alabama River below Millers Ferry

Mobile-Tombigbee Subregion

1. Suspended-sediment data are being collected 10 times per year at Tombigbee River at Gainesville, AL, and at Black Warrior River at Northport, AL, in cooperation with the COE, monthly at Tombigbee River at Gainesville, bimonthly at Black Warrior River below Warrior Dam near Eutaw, AL, and quarterly at Tombigbee River at Coffeeville lock and dam, AL, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Blackwater River near Bradley and Sipsey Fork near Grayson, AL, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a periodic basis in cooperation with the COE at the following sites:

Tombigbee River at Pickensville, AL
Tombigbee River near Cochrane, AL
Tombigbee River near Nanafalia, AL
Tombigbee River at Jackson Bridge, AL

4. Suspended-sediment data are being collected on a periodic basis in cooperation with the COE at the following sites:

Tombigbee River near Marrietta, MS
Twentymile Creek near Guntown, MS
Twentymile Creek near Mantachie, MS
Tombigbee River near Fulton, MS
Mantachie Creek below Dorsey, MS
Tombigbee River at Bigbee, MS
Tombigbee River near Amory, MS
Tombigbee River at Aberdeen, MS
Buttahatchie River near Aberdeen, MS
Tombigbee River near Columbus, MS
Luxapallila Creek near Columbus, MS
Town Creek at Nettleton, MS
Noxubee River at Macon, MS

Additional data are being collected on two storm events per year at the following sites:

Tombigbee River near Fulton, MS
Mantachie Creek below Dorsey, MS
Tombigbee River at Aberdeen, MS
Town Creek at Nettleton, MS
Noxubee River at Macon, MS

Pascagoula Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Pascagoula River near Benndale, MS, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Cypress Creek near Janice, MS, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a quarterly basis at Escatawpa River near Agricola, MS, as part of NASQAN.

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 bimonthly basis at Bogue Chitto River near Bush, LA, as a part of NASQAN.

Special Studies

1. Suspended-sediment and bed-material data are being collected periodically and during two storm events per year at five sites in order to gage sediment deposition in certain Georgia reservoirs as part of a cooperative program with the COE.

2. Suspended-sediment data are collected monthly at seven sites as part of the surface-water quality assessment for the Triangle J COG Region located in the central Piedmont of North Carolina. The data are collected in cooperation with the Triangle Area Water-Supply Monitoring Project Steering Committee.

3. Suspended-sediment data are collected bimonthly and twice each water year during runoff conditions at three sites in the Treyburn Project, a large-scale development in the upper Neuse River basin in cooperation with the City of Durham. This data is needed to assess impacts of various land-use development on surface-water quality.

4. Two reports describing the results of the study on sedimentation and its effects on Lake Michie, located in northern Durham County, NC, are being prepared for eventual publication. The first report, approved for publication, presents a bathymetric map of the lake bottom. The second report, being prepared for review, discusses the characteristics of sediments in Lake Michie and presents historical and current sedimentation rates. The study was conducted in cooperation with the City of Durham and the North Carolina Department of Environment, Health, and Natural Resources.

5. The South Carolina District continued sediment data collection associated with NASQAN and Benchmark stations.

6. Changes in channel bathymetry were measured over a tide cycle in February at Altamaha River at Interstate 95 as part of a bridge scour study being done in cooperation with the Federal Highway Administration.

7. In February 1993, the South Carolina District made a resurvey of Lake Katherine, a small residential lake in Columbis, SC, as part of an agreement with the South Carolina Department of Highways and Public Transportation. The initial bathymetric survey was in 1989, prior to construction of an interstate highway connector near the lake. A report on bathymetric changes in the lake is being prepared.

8. Suspended-sediment and bedload data are being collected at 10 streamflow stations in the Albemarle-Pamlico Drainage (ALBE) study unit, located in portions of the Piedmont and Coastal Plain provinces of North Carolina and Virginia. Samples are collected on a weekly basis for three of the stations and on a monthly basis for seven stations; samples are collected more frequently during storm events at all 10 stations. As part of the National Water Quality Assessment (NAWQA) program, the data will be part of that collected to characterize the water-quality conditions and trends in river basins that drain to the biologically sensitive waters of the Albemarle and Pamlico Sounds.

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

District Chief, WRD
U.S. Geological Survey
520 19th Avenue
Tuscaloosa, AL 35401

District Chief, WRD
U.S. Geological Survey
227 N. Bronough Street, Suite 3015
Tallahassee, FL 32301

District Chief, WRD
U.S. Geological Survey
3039 Amwiler Road
Suite 130
Atlanta, GA 30360

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

District Chief, WRD
U.S. Geological Survey
Suite 710, Federal Building
100 West Capitol Street
Jackson, MS 39269

District Chief, WRD
U.S. Geological Survey
3916 Sunset Ridge Road
Raleigh, NC 27607

District Chief, WRD
U.S. Geological Survey
Stephenson Center
720 Gracern Road
Suite 129
Columbia, SC 29210

Chief, Virginia Office, WRD
U.S. Geological Survey
3600 West Broad Street, Room 606
Richmond, VA 23230

SOUTH ATLANTIC--GULF (03) REGION

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities.

   a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Choctawhatchee	Northeast Yellow River (continuation)	Yellow River Crenshaw	Coffee, Covington,	AL
Alabama	Swift Creek	Trib. to Alabama R.	Chilton	AL
Middle Tennessee Elk	Piney Creek	Trib. to Tennessee R.	Limestone Giles	AL TN
Middle Tennessee Elk	Crowdabout Creek	Trib. to Flint Creek	Morgan	AL
Middle Tennessee Elk	Scarham Creek 1/ (continuation)	Trib. to Tennessee R.	DeKalb, Marshall	AL
Middle Tennessee Elk	South Sauty Creek 1/	Trib. to Tennessee R.	DeKalb, Marshall	AL
Middle Tennessee Elk	Town Creek 1/	Trib. to Tennessee R.	Dekalb, Marshall	AL
Mobile-Tombigbee	Duck Creek	Trib. to Mulberry Fork	Cullman	AL
All--Statewide including Tennessee Basin	Sediment yield from agricultural lands	All	All	GA
	Five Points Area	Flint River	Macon, Dooly, Houston Greene	GA
Pee Dee	Ararat	Numerous small tribs.	Carrol, Patrick	VA
Pee Dee	Woodrow	Tributary to Cowpen Swamppt & Black River	Lee	SC
Pee DeThompson-Westfield	Deep Creek Creek	Chesterfield,	SC Annson, Union	

1/ This PL-566 project is a part of the Sand Mountain--Lake Guntersville Hydrologic Unit Area Project. Erosion and sedimentation studies were conducted for this project utilizing the following computer models: Agricultural Nonpoint Source Pollution ("AGNPS", Young et. al., ARS, 1989) and Groundwater Loading Effects of Agricultural Management Systems ("GLEAMS", Leonard et. al., ARS, 1987).

b. Public Law-639

Major Drainage	Watershed	Stream	County	State
Choctawhatchee	Choctawhatchee	Choctawatchee and	9 counties	AL
Escambia	Pea River Basin	Pea River and tribs.	5 counties	FL

2. Special Studies

Virginia: A statewide estimate of erosion and sediment yield was conducted in Virginia within 491 hydrologic units or watersheds using GIS data layers in cooperation with the Virginia Division of Soil and Water as part of a Non-point Source Pollution Targeting Project.

CORPS OF ENGINEERS

North Central Division

Buffalo District

Mt. Morris Dam, Genesee River, New York, Report of Sedimentation, 1992 Resurvey.

Introduction: The purpose of this investigation was to determine the effects of erosion and deposition and whether significant quantities of sediment have accumulated behind the dam thus reducing the storage capacity.

A sediment transport analysis was performed using the HEC-6 model, Scour and Deposition in Rivers and Reservoirs. The purpose of the modeling effort was to simulate various historical events and assess the amount of deposition associated with each event. A better understanding of the quantity of sediment that deposits with respect to actual events is critical in determining the frequency of scheduling resurveys of the reservoir.

Results: Based on the apparent negligible change in storage over the last 10 year period, it is questionable as to whether sediment resurveys should be scheduled on a regular 10 year interval. It was recommended to increase the resurvey interval to 15 years (the next one in the year 2005) unless a storm with a recurrence interval of 25 years occurs during that period of time.

It was also recommended that a land survey be performed of the sediment bars in lower reaches of the reservoir to more accurately define the most rapidly accumulating areas. The land survey of the lower reaches could be performed on a more frequent time interval to assess the actual changes in this portion of the reservoir.

Sediment Quality Monitoring Summary.

Project description:

Project, State	Number of Stations
Ashtabula, OH[1]	19
Buffalo, NY[2]	Special Study
Cuyahoga River, OH	3
Erie, PA	15
Oak Orchard, NY	9
Port Clinton, OH	5
Presque Isle, PA[3]	Sand Testing
Toledo, OH[4]	10
Vermilion, OH	11
Wilson, NY	7

The above projects are usually sampled on a 5-year basis. If conditions warrant special considerations or sampling, sediment sampling is done on an as-needed bases. Elutriate and biological toxicity testing is

usually not done for areas where sediment is disposed of in Confined Disposal Facilities (CDFs).

[1]Also PCB sediment core sampling.
[2]Special Study - Water chemistry at dredge head, above and below dredging operations.
[3]Biological testing - for bacteria in replacement sand.
[4]Special testing - for new biological testing procedures being developed - column settling testing.

2. Analyses performed:

Bulk Chemical - metals, pesticides & PCB's, volatile organics, cyanide, total phosphorus, total Kjeldahl nitrogen, ammonia nitrogen, chemical oxygen demand (COD), polynuclear aromatic hydrocarbons (PAH's), total organic carbon (TOC), oil & grease.

Physical - particle size distribution and visual description of sediment.

Elutriate - metals, cyanide, total phosphorus, total Kjeldahl nitrogen, ammonia, nitrogen, oil & grease.

Biological - 96 hour acute toxicity testing using some of the following organisms; fathead minnows, mayfly larvae, midge fly larvae, daphnia, scuds.

Chicago District

Sedimentation Activities.

1. Michigan City Harbor, Michigan City, Indiana. The District dredged approximately 65,000 cubic yards of sediment from the outer harbor in July, 1992 and deposited the material in Lake Michigan. As part of the effort to develop a long term management strategy at the harbor, a sediment management investigation report prepared. Major discussions in the report include sediment chemical characteristics, the possibility of constructing a sediment trap upstream of the federal channel, results of a sedimentation model developed for the Trail Creek basin, dredging and disposal alternatives, and recommendations for future work. A final draft of this report is expected in early December, 1993. Additionally, samples from the harbor are being utilized in bioassay study being conducted by WES, the results will help develop a transition line between clean and contaminated sediments, and ultimately confined or open water disposal.

2. Waukegan Harbor, Waukegan, Illinois. Samples from the federal channel were collected for use in a PCB bioaccumulation analysis being done by WES. The outer harbor is planned for dredging in the spring of 1993.

3. Burns International Harbor, Portage, Indiana. During fiscal year 1993 the District plans to conduct a 404 (b)1 evaluation of sediments. The evaluation will include bulk and elutriate chemistry, and effects-based bioassay testing.

4. Lake George, Hobart, Indiana. The District collected sediment samples from Lake George during FY 1992. The samples were analyzed for bulk and elutriate chemistry. The sediment analytical results show that confined disposal of the sediments is not required. Metal concentrations are all at acceptable limits, very close to the levels found in soils from the area and all below the sediment pollutant background levels for the state of Indiana. However, QA/QC analyses show that the reported lead concentrations are inconclusive. Some type of settling basin would be required to de-water the sediments. The effluent would possibly require treatment for ammonia removal prior to discharge. The de-watered sediments may be used for beneficial purposes.

Detroit District

Sediment Sampling Activities. Environmental Analysis - In 1992, sediment and water sampling were obtained at the following locations for environmental analysis:

Ashland, MI
Bayfield, WI
Cheboygan, MI
Duluth-Superior, MN-WI
Flint River, MI
Frankfort, MI
Grand Haven, MI
Grand River, MI
Holland, MI
Inland Route, MI
Kewaunee, WI
Leland, MI
Milwaukee, WI
(Lincoln Creek)
Pentwater, MI
Pointe Lookout, MI
Portage Lake, MI
Presque Isle, MI
Saginaw River, MI
South Haven, MI
St. Marys River, MI
Sturgeon Bay, WI

Sediments were analyzed for metals, PCB's, pesticides, nutrients, and physical parameters. Water samples were also collected concurrently to determine ambient water quality conditions.

Special Studies.

1. St. Joseph Harbor. A reconnaissance study of St. Joseph Harbor, presented in a November 1990 report, concluded that a Federal commercial navigation modification deepening project would be economically and environmentally feasible. The report recommended continuing the project into the feasibility phase. At the Reconnaissance Review Conference (January 1991), HQUSACE delayed completion of the reconnaissance phase of the study pending resolution of the O&M dredged material disposal issue at the harbor.

The local sponsor subsequently made efforts to identify a viable long-term O&M disposal site. Strong local opposition at a June 1992 meeting indefinitely delayed further local sponsor support of the potential disposal site under consideration. The District Commander met with the local sponsor and the harbor users in September 1992 to discuss O&M disposal, but no further local progress was made toward identifying a viable O&M disposal site.

2. Grand Haven Harbor, Michigan. Grand Haven Harbor modifications were authorized by the Water Resources Development Act of 1986. Project

preconstruction, engineering, and design (PED) were initiated in CY 92.

The authorized project modifications consist of increasing channel controlling depths by 6 feet (deepening existing 21-foot channel to 27 feet, and 23-foot channel to 29 feet) and relocating and constructing a new turning basin.

In support of the Grand Haven Channel Modification project, the District collected sediment boring throughout the project area during 1991. In order to meet the project schedule, the environmental contractor subcontracted a 200-foot barge and tug and positioned a truck-mounted drilling rig on the barge. The stability of this configuration allowed the sampling to occur in less-than-ideal weather conditions in December.

In response to the local sponsor's request to attempt to reduce project costs while still meeting the needs of prospective commerce, the reevaluation examined eight alternative scenarios (1,2,3,6-foot deepening, each with and without a turning basin) to the authorized project modifications. All scenarios demonstrated a benefit-to-cost ratio below unity.

The reevaluation, presented in a September 1992 Preliminary Reevaluation Report concluded that it would not be economically justified, at this time, to deepen the harbor further for commercial navigation.

3. Flint River Flood Control. As part of the Energy and Water Resources Development Act of 1992, the District conducted an extensive rehabilitation of the Flood Control Project at Flint, Michigan. The effort included sampling and analysis of the shoaled material in the channel.

A property audit conducted on the disposal site provided by the City of Flint found the site to be a former junkyard with a high potential for encountering hazardous material. A Phase II property audit was rapidly conducted at the site and found elevated concentrations of some constituents in the soil at that site. After coordination with the local sponsor, the District was able to utilize the clean dredged material as a cap for the contaminated soils. The project was able to proceed while on a very strict schedule.

Additional funding has been provided in FY 93 to conduct maintenance on another section of the flood control project.

GREAT LAKES REGION

GEOLOGICAL SURVEY

Western Lake Superior Subregion

1. Suspended-sediment data are being collected on a periodic and storm-event basis at Bad River near Odanah, WI, on a quarterly basis at Baptism River near Beaver Bay, MN, and on a bimonthly basis at St. Louis River at Scanlon, MN, as a part of the National Stream Quality Accounting Network (NASQAN).

Southern Lake Superior-Lake Superior Subregion

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

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

Northwestern Lake Michigan Subregion

1. Suspended-sediment data are being collected on an intermittent basis at Popple River near Fence, WI, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a storm-event basis at Duck Creek near Howard, WI. These data are being collected in cooperation with the Oneida Indian Tribe of Wisconsin.

3. Suspended-sediment data are being collected on a bimonthly basis at Fox River at Wrightstown, WI, and Escanaba River at Cornell, MI, and on a quarterly basis at Ford River near Hyde, MI, as a part of NASQAN.

4. Suspended-sediment data are being collected on a periodic and storm-event basis at White Creek at Forest Glen Beach, Silver Creek and Green Lake Inlet near Green Lake, WI, in cooperation with the Green Lake Sanitary District.

Southwestern Lake Michigan Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Milwaukee River at Milwaukee, WI, and at Manitowac River at Manitowac, WI, as a part of NASQAN.

2. Suspended-sediment data are being collected daily at Trail Creek at Michigan City, IN, at a fixed sampling location by an observer. USGS personnel samples sediment over the cross section of the creek every 3 to 4 weeks.

3. Suspended-sediment data are being collected periodically at Deep River and Turkey Creek near Hobart, IN, in cooperation with the U.S. Army Corps of Engineers, Chicago District.

Southeastern Lake Michigan Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Grand River at Eastmanville, MI, St. Joseph River at Niles, MI, and Kalamazoo River near Fennville, MI, as a part of NASQAN.

Northeastern Lake Michigan-Lake Michigan Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Manistee River at Manistee, MI, as a part of NASQAN.

Northwestern Lake Huron Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Thunder Bay River at Alpena, MI, and Au Sable River near Au Sable, MI, as a part of NASQAN.

Southwestern Lake Huron-Lake Huron Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Pigeon River near Caseville, MI, Rifle River near Sterling, MI, and bimonthly at Tittabawassee River near Midland, MI, as a part of NASQAN. Suspended-sediment data are being collected on a quarterly basis at Saginaw River at Saginaw, MI, in cooperation with the Detroit District Corps of Engineers.

St. Clair-Detroit River Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Clinton River at Mount Clemens, MI, as a part of NASQAN.

Western Lake Erie Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Maumee River at Waterville, OH, and Sandusky River at Fremont, OH, as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Sandusky River near Fremont, OH, Maumee River at Waterville, OH, in cooperation with the Ohio Department of Natural Resources.

3. Suspended-sediment data are being collected on a quarterly basis at River Raisin near Monroe, MI, as a part of NASQAN.

Southern Lake Erie Subregion

1. Suspended-sediment data are being collected on a daily basis at Cuyahoga River at Independence, OH, in cooperation with the Ohio Department of Natural Resources, and on a quarterly basis as part of NASQAN.

Eastern Lake Erie-Lake Erie Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Cattaraugas Creek at Gowanda, NY, and Niagara River (Lake Ontario) at Fort Niagara, NY, as a part of NASQAN.

Southwestern Lake Ontario Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Genesee River at Charlotte Docks at Rochester, NY, as a part of NASQAN.

Southeastern Lake Ontario Subregion

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

2. Suspended-sediment data are being collected daily and during storm events downstream of the mudboil area near Tully Valley, NY, on Tributary Number 6 to Onondaga Creek, in cooperation with the U.S. Environmental Protection Agency and the Onodaga Lake Management Conference.

Northeastern Lake Ontario-Lake Ontario-St. Lawrence Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Black River at Watertown, NY, and on a quarterly basis at Raquette River at Raymondville, NY, St. Regis River at Brasher Center, NY, and St. Lawrence River at Cornwall, Ontario, near Massena, NY, 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
Champaign County Bank Plaza
102 East Main St., 4th Floor
Urbana, IL 61801

District Chief, WRD
U.S. Geological Survey
2280 Woodale Drive
Mounds View, MN 55112

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

District Chief, WRD
U.S. Geological Survey
5957 Lakeside Boulevard
Indianapolis, IN 46254

District Chief, WRD
U.S. Geological Survey
6520 Mercantile Way, Suite 5
Lansing, MI 48911

District Chief, WRD
U.S. Geological Survey
P.O. Box 1669
Albany, NY 12201

District Chief, WRD
U. S. Geological Survey
6417 Normandy Lane
Madison, WI 53719

GREAT LAKES (04) REGION

SOIL CONSERVATION SERVICE

1. Reservoir Sedimentation Surveys

Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Tappan Lake	Harrison	OH
Clendening Lake	Harrison	OH
Charles Mill Lake	Ashland, Richland	OH
Barberton Reservoir	Summit	OH
Silver Lake	Summit	OH

2. Special Studies

Ohio: A report on the Maumee River Basin, "Erosion and Sedimentation Dynamics of the Maumee River Basin and Their Impact on Toledo Harbor" was published.

New York: A streambank and roadbank erosion inventory is currently being conducted within the Onondaga Lake Watershed, Onondaga County, NY. The watershed drains an area of 297 mi^2 and contains three hydrologic watershed units. Data from the roadbank portion of the study is complete and shows that approximately 318 tons of sediment is displaced each year by roadbank erosion. This equates to an annual rate of 0.5 tons/bank mile. Of this, the net amount entering Onondaga Lake is 13.8 tons/year. This low rate of sediment delivery is due primarily to the trap efficiency of two dams which are located on Onondaga Creek and Otisco Lake.

OHIO REGION

CORPS OF ENGINEERS

OHIO RIVER DIVISION

Huntington District

Sedimentation Survey Reports.

1. Grayson Lake, Little Sandy River, Kentucky. A report on the 1987 resurvey of 19 ranges in the seasonal pool area and 2 ranges downstream of the dam was submitted to and approved by the Ohio River Division in 1992. The annual rate of sedimentation in the seasonal pool at Grayson Lake for the period of lake operation was computed to be 0.31 acre-feet per square mile of contributing area.

2. Paint Creek Lake, Paint Creek, Ohio. A draft report on the 1986 resurvey of 15 ranges in the seasonal pool area and 3 ranges downstream of the dam was prepared in 1992. The final report will be submitted to the Ohio River Division in the near future. The annual rate of sedimentation in the seasonal pool at Paint Creek Lake for the period of lake operation was computed to be 0.28 acre-feet per square mile of contributing drainage area.

3. North Branch of Kokosing Lake, North Branch of Kokosing River, Ohio. A draft report on the 1987 resurvey of 11 ranges in the flood control pool area and 2 ranges downstream of the dam was prepared in 1992. The final report will be submitted to the Ohio River Division in the near future. The annual rate of sedimentation in the flood control pool at North Branch of Kokosing Lake for the period of operation was computed to be 0.22 acre-feet per square mile of contributing drainage area.

Sedimentation Surveys. Hocking River, Athens, Ohio. Bed and suspended sediment samples were collected during a high water event on 15 July 1992. Bed samples were also collected during low water conditions from instream and bank locations on 26 August 1992. The samples were analyzed to determine grain size distribution. This data was collected for use in the HEC-6 analysis of sediment transport through the Athens, Ohio Local Protection Project reach. This analysis is currently in progress.

Louisville District

Sedimentation Surveys.

1. Rough River Lake. Field surveys were completed for the lake. Data will be ready for analysis in approximately six weeks.

2. William Harsha Lake. Field surveys were completed for the lake. Data will be ready for analysis in approximately six weeks.

3. C.M. Harden Lake. The analysis of sedimentation data for C.M. Harden Lake taken in a 1988 survey is finished and the resulting report is nearing completion.

Nashville District

Sedimentation Surveys.

1. J. Percy Priest. The sediment ranges were resurveyed during July 1992. The report on the findings of the survey will be completed in March 1993.

2. Marins Fork. The sediment ranges were resurveyed during July 1992. The report on the findings of the survey will be completed in February 1993.

3. Middlesboro. The 28 sedimentation ranges established in the Yellow Creek Bypass in 1965 and 1983 were resurveyed in January 1992. A survey to determine the top of levee profile was made. Computations by the District indicate that the Bypass can adequately pass the Standard Project Flood. The new range survey was incorporated into the numerical model study performed by the Waterways Experiment Station (WES). WES concluded the model testing for the Yellow Creek Bypass in September 1992. A recommended cross section was presented for the existing Bypass channel as well as a design recommendation for a proposed channel enlargement on Yellow Creek. The study is presently awaiting publication and distribution to Corps elements. A technical paper was presented at the Conference in Seattle, Washington in October 1992.

Pittsburgh District

Sedimentation Surveys. Conemaugh River Lake, Conemaugh River, Pennsylvania. Results of the reservoir sedimentation studies indicate all projects except Conemaugh River Lake do not have excessive sediment deposition. The Conemaugh River Lake sedimentation study is currently being investigated by the WES.

A detailed sedimentation report for the 1982 Conemaugh River Lake survey was submitted in FY 1985 to Ohio River Division. Review comments by the Division and headquarter have been received. Resolution of these comments will be finalized after the sediment removal activities, which will be adopted from the ongoing WES study, are selected.

OHIO REGION

GEOLOGICAL SURVEY

Upper Ohio Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Allegheny River at New Kensington, PA, Monongahela River at Braddock, PA, Beaver River at Beaver Falls, PA, and on a bimonthly basis at Ohio River at Benwood, near Wheeling, WV, and at Little Kanawha River at Palestine, WV, as a part of the National Stream Quality Accounting Network (NASQAN).

Muskingum Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at the Muskingum River at McConnelsville, OH, as a part of NASQAN.

Hocking Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Hocking River below Athens, OH, as a part of NASQAN.

Kanawha Subregion

1. Suspended-sediment data are being collected five times per year at the New River at Glen Lyn, VA, as part of the NASQAN program

2. Suspended-sediment data are being collected on a quarterly basis at Kanawha River at Winfield, WV, as a part of NASQAN.

Scioto Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Scioto River at Higby, OH, as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Little Darby Creek at West Jefferson, OH, Hellbranch Run near Harrisburg, OH, and Big Darby Creek near Darbyville, OH, in cooperation with the City of Columbus, OH.

Big Sandy-Guyandotte Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Guyandotte River at Branchland, WV, as a part of NASQAN.

2. Suspended-sediment data are being collected on a bimonthly basis at Big Sandy River at Louisa, KY, as part of NASQAN.

Great Miami Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Whitewater River near Alpine, IN, as a part of NASQAN.

2. Suspended-sediment data are being collected on a bimonthly basis at Great Miami River at New Baltimore, OH, and Little Miami River at Milford, OH, as a part of NASQAN.

Middle Ohio Subregion

1. Suspended-sediment data are being collected on a monthly basis at Upper Twin Creek at McGaw, OH, and on a quarterly basis at South Hogan Creek near Dillsboro, IN, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a bimonthly basis at Little Miami River at Milford, OH, as a part of NASQAN.

Kentucky-Licking Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Licking River at Butler, KY, and on a bimonthly basis at Kentucky River at Lock 2 at Lockport, KY, as a part of NASQAN.

Green Subregion

1. 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, and on a bimonthly basis as part of NASQAN.

Wabash Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at White River near Centerton, IN, as a part of NASQAN.

2. Suspended-sediment data are being collected on a monthly basis at Little Eagle Creek at 52nd Street at Indianapolis, IN, Little Eagle Creek at Speedway, IN, Little Buck Creek near Southport, IN, and Little Buck Creek near Indianapolis, IN.

3. Suspended-sediment data are being collected on a bimonthly basis at Little Wabash River at Main Street at Carmi, IL, and Embarras River at Sainte Marie, IL, as a part of NASQAN.

4. During the period of May to August, suspended-sediment data were collected on a weekly basis at Sugar Creek at New Palestine, IN, on a twice weekly basis at Little Buck Creek near Indianapolis, IN, and on a twice monthly basis at White River at Hazleton, IN, as a part of the White River basin study of the National Water Quality Assessment Program.

Cumberland Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at South Fork Cumberland River near Stearns, KY, and five times per year at Cumberland River at Carthage, TN, as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily and storm-event basis in cooperation with the COE, Nashville District, at the following stations:

Clover Fork at Harlan, KY
Yellow Creek near Middlesboro, KY
Cumberland River at Barbourville, KY
Cumberland River at Williamsburg, KY

Lower Ohio Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Rolling Fork near Lebanon Junction, KY, and on a bimonthly basis at Ohio River at Lock and Dam 53 near Grand Chain, IL, Whitewater River near Alpine, IN, and Salt River at Shepherdsville, KY, (Discontinued September 30, 1992), as part of NASQAN.

2. Suspended-sediment data are being collected quarterly at South Hogan Creek near Dillsboro, IN, as part of the National Hydrologic Benchmark Network.

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

District Chief, WRD
U.S. Geological Survey
Busey County Bank Plaza
102 East Main Street, 4th Floor
Urbana, IL 61801

District Chief, WRD
U.S. Geological Survey
5957 Lakeside Boulevard
Indianapolis, IN 46278

District Chief, WRD
U. S. Geological Survey
208 Carroll Building
8600 La Salle Road
Towson, MD 21204

District Chief, WRD
U.S. Geological Survey
840 Market Street
Lemoyne, PA 17043-1586

District Chief, WRD
U.S. Geological Survey
810 Broadway, Suite 500
Nashville, TN 37203

Chief, Virginia Office, WRD
U.S. Geological Survey
3600 West Broad Street, Rm. 606
Richmond, VA 23230

District Chief, WRD
U.S. Geological Survey
2301 Bradley Avenue
Louisville, KY 40217

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

District Chief, WRD
U.S. Geological Survey
603 Morris Street
Charleston, WV 25301

OHIO (05) REGION

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities.

a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Sandy Lick Creek	Pitchpine Run	Pitchpine Run	Jefferson	PA

b. River Basin Studies

Major Drainage	Watershed	State
Kanawha	New River	VA

3. Special Studies

Indiana: Erosion rate and sediment delivery calculations are complete for the 3,700-acre Cox Ditch Watershed in Vigo County, Indiana.

Virginia: A bedload transport and channel stability model study was conducted on Howard Creek, a tributary of the Greenbriar River in White Sulphur Springs, West Virginia. A statewide estimate of erosion and sediment yield was conducted in Virginia within 491 hydrologic units or watersheds using GIS data layers in cooperation with the Virginia Division of Soil and Water as part of a Non-point Source Pollution Targeting Project.

TENNESSEE REGION

GEOLOGICAL SURVEY

Upper Tennessee Subregion

1. Suspended-sediment data are being collected on a quarterly basis at French Broad River at Marshall, NC, and bimonthly at Clinch River at Melton Hill Dam, TN, and Holston River near Knoxville, TN, as part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are collected on a bimonthly basis at Little River above Townsend, TN, and quarterly at Cataloochee Creek near Cataloochee, NC, as a part of the National Hydrologic Benchmark program.

Lower Tennessee Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Tennessee River at Pickwick Landing Dam, TN, as a part of NASQAN.

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

Special Studies

1. Suspended-sediment data are being collected four times per year at three sites along Carters Creek, Maury County, TN, as part of a monitoring program designed to assess effects of large-scale construction activities.

2. Suspended-sediment data are being collected on a stormevent basis by the U.S.Geological Survey at one site on the Clinch River, TN, and one site on the Powell River, TN, as part of a study to define the variability in suspended sediment and nutrients in the two basins.

3. Suspended-sediment data are being collected on a stormevent basis at five sites in the Metropolitan Nashville, TN, area as part of the Urban Stormwater Quality Project.

4. Suspended-sediment data are being collected on a stormevent basis at five sites in Metropolitan Knoxville, TN, and five sites in the Chattanooga, TN, area as part of the Urban Stormwater Quality Project.

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

District Chief, WRD
U.S. Geological Survey
2301 Bradley Avenue
Louisville, KY 40202

District Chief, WRD
U.S. Geololgical Survey
Suite 710, Federal Building
100 West Capitol Street
Jackson, MS 39269

District Chief, WRD
U.S. Geological Survey
3916 Sunset Ridge Road
Raleigh, NC 27607

District Chief, WRD
U.S. Geological Survey
810 Broadway, Suite 500
Nashville, TN 37203

TENNESSEE REGION (06)

SOIL CONSERVATION SERVICE

1. A Study of sediment damages and determinations of sediment yield were made for work plans in the following watersheds:

a. Public Law-639

Major Drainage	Watershed	Stream	County	State
Hiwassee River Tennessee River	Nottely River Wshd.	Nottely River	Cherokee	NC

b. River Basin Studies

Major Drainage	Watershed	State
Tennessee	Clinch River	VA
Tennessee	Powell River	VA

2. Special Studies

Virginia: A statewide estimate of erosion and sediment yield was conducted in Virginia within 491 hydrologic units or watersheds using GIS data layers in cooperation with the Virginia Division of Soil and Water as part of a Non-point Source Pollution Targeting Project.

UPPER MISSISSIPPI REGION

CORPS OF ENGINEERS

North Central Division

Rock Island District

Suspended Sediment Sampling. Suspended load sampling is being conducted at 22 stations, 3 located on the Mississippi River, 17 located on tributaries to the Mississippi River, and 2 on tributaries to the Illinois River. Of these 22 stations, 4 are being operated and maintained under a cooperative program with the U.S. Geological Survey while the remaining stations are operated independently. Samplers D-49 and D-74 were used.

Sedimentation Surveys. Sedimentation survey reports for Farmdale and Fondulac Reservoirs in Illinois will be published this fiscal year.

St. Paul District

Sediment Load Measurements. Both suspended and bedload measurements were conducted at four stations by the U.S. Geological Survey under the sponsorship of the District and published in the USGS Water Resources Data. These stations are at Anoka, MN on the Mississippi River (sampled daily); at Winona, MN on the Mississippi River (sampled monthly); at McGregor, IA on the Mississippi River (sampled every 4-5 days) and at Mankato, MN on the Minnesota River (sampled daily).

Sedimentation Surveys.

1. Lansing Big Lake, Mississippi River Pool 10, Iowa. Bathimetric surveys have been taken of the lake bed of Lansing Big Lake. The measurements have been taken by the Corps of Engineers in conjunction with the Iowa Department of Natural Resources. The data is not available in publication.

2. Island 42, Mississippi River Pool 5, Minnesota. Cross sections were surveyed across an excavated channel. A publication will not be available until 1993.

3. Finger Lakes, Mississippi River, Pool 5, Minnesota. The Corps of Engineers, St. Paul District, has funded a bathimetric survey of the Finger Lakes. The work was done by the U.S. Fish and Wildlife Service's Environmental Management Technical Center in Onalaska, Wisconsin. The publication "Hydrologic Modification for Habitat Improvement in the Finger Lakes: Management Objectives, Approach, and Initial Findings" was prepared by:

U.S. Fish and Wildlife Service
Environmental Management Technical Center
Onalaska, Wisconsin

U.S. Fish and Wildlife Service
National Fisheries Research Center
La Crosse, Wisconsin

U.S. Army Corps of Engineers
Waterways Experiment Station
Eau Galle Limnological Laboratory
Spring Valley, Wisconsin

4. Weaver Bottoms, Mississippi River Pool 5, Minnesota. Bathimetric data was collected to monitor the impact of the Weaver Bottoms Project. Soundings obtained within Weaver Bottoms from 1990-1992, have been compared to elevation data obtained in 1986 and 1932. The result will be published in 1993 in an inter-agency report: "The Weaver Bottoms Rehabilitation Project, Resource Analysis Program Interim Report, 1985-1991."

UPPER MISSISSIPPI REGION

GEOLOGICAL SURVEY

Mississippi Headwaters Subregion

1. Suspended-sediment data are being collected on a daily basis during open water at Mississippi River near Anoka, MN, in cooperation with the U.S. Army Corps of Engineers (COE).

2. Suspended-sediment data are being collected on a bimonthly basis at Mississippi River near Royalton, MN, and on a quarterly basis at Mississippi River at Nininger, MN, as a part of the National Stream Quality Accounting Network (NASQAN).

Minnesota Subregion

1. Suspended-sediment data are being collected on a daily basis during open water at Minnesota River at Mankato, MN, in cooperation with the COE.

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

Chippewa Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Chippewa River near Durand, WI, as a part of NASQAN.

Upper Mississippi-Black-Whitewater Subregion

1. Suspended-sediment data are being collected during high-flow events and on a bimonthly basis at North Fork Whitewater River near Elba, MN, in cooperation with the Whitewater Watershed Joint Powers Board and as part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected during high-flow events at Middle Fork Whitewater River near St. Charles, MN, South Fork Whitewater River near Altura, MN, and at Whitewater River near Beaver, MN, in cooperation with the Whitewater Watershed Joint Powers Board.

3. Suspended and bedload (Helley-Smith) sediment and bed material are being collected on an intermittent basis at Joos Valley Creek, Eagle Creek at Schaffner Road, and Eagle Creek at CTH G near Fountain City, WI. These data are being collected in cooperation with the Wisconsin Department of Natural Resources.

4. Suspended-sediment data are being collected periodically at Mississippi River at Winona, MN, in cooperation with the COE.

5. Suspended-sediment data are being collected on a bimonthly basis at Black River at Galesville, WI, as a part of NASQAN.

Upper Mississippi-Maquoketa-Plum Subregion

1. Suspended-sediment data are being collected on a daily basis at Mississippi River at McGregor, IA, in cooperation with the COE, St. Paul District.

2. Suspended-sediment data are being collected on a daily basis at Bloody Run Creek near Marquette and Sny Magill Creek near Clayton, IA, in cooperation with the Iowa Department of Natural Resources, Geological Survey Bureau.

3. Suspended-sediment data are being collected on a periodic and storm-event basis to determine monthly suspended-sediment loads for the COE at the Grant River at Burton, WI.

Wisconsin Subregion

1. Suspended-sediment and bed-material data are being collected on a bimonthly basis at Ten Mile Creek near Nekoosa and Wisconsin River at Muscoda, WI, as part of NASQAN.

Upper Mississippi-Turkey Subregion

1. Suspended-sediment data are being collected on a monthly basis in cooperation with the Iowa Department of Natural Resources, Geological Survey Bureau at Roberts Creek above Saint Olaf, IA, and at Big Spring near Elkader, IA.

Upper Mississippi-Iowa-Skunk-Wapsipinicon Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Cedar River at Cedar Falls, IA, as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at the following in cooperation with the Iowa Department of Natural Resources, Geological Survey Bureau:

Iowa River at Marshalltown, IA
South Skunk River at Colfax, IA
Skunk River at Augusta, IA

3. Suspended-sediment data are also being collected on a bimonthly basis at Skunk River at Augusta, IA, as part of NASQAN.

4. Suspended-sediment data are being collected on a daily basis at Iowa River at Wapello, IA, in cooperation with COE, Rock Island District. Suspended-sediment data are also being collected on a bimonthly basis as part of NASQAN.

Rock Subregion

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

Jackson Creek at County Highway H near Elkhorn, WI
Jackson Creek tributary near Elkhorn, WI
Delavan Lake tributary at South Shore Drive at Delavan Lake, WI

These data are being collected in cooperation with the Delavan Lake Sanitary District.

1. Suspended-sediment data are being collected on a periodic and storm-event basis at Yahava River near Windsor, WI. These data are being collected in cooperation with the Dane County Regional Planning Commission.

2. Suspended-sediment data are being collected on a storm-event basis in cooperation with Dane County, WI, at:

Pheasant Branch Creek at Middleton, WI, at U.S. Highway 12
Spring Harbor Storm Sewer at Madison, WI
Yahiva River at Windson, WI

3. Suspended-sediment data are being collected on a quarterly basis at Rock River near Joslin, IL, as 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 COE, Rock Island District.

2. Suspended-sediment data are being collected on a daily basis at Hazelbrush Creek near Maple River, IA, in cooperation with the University of Iowa (Department of Preventive Medicine) and the Agricultural Research Service.

3. Suspended-sediment data are being collected on a bimonthly basis at Raccoon River at Van Meter, IA, as a part of NASQAN.

4. Suspended-sediment data are being collected on a weekly basis at Des Moines River at St. Francisville, MO, in cooperation with the COE, Rock Island District, and bimonthly as part of NASQAN.

Upper Mississippi-Salt-Subregion

1. Suspended-sediment data are being collected on a daily basis and particle-size data collected on a intermittent basis in cooperation with the COE, St. Louis District, at the following stations:

North Fork Salt River near Shelbina, MO
Middle Fork Salt River at Paris, MO

2. Suspended-sediment data are being collected on an event basis at the Salt River near New London, MO, in cooperation with the COE, St. Louis District.

3. Suspended-sediment data are being collected on a daily basis at Mississippi River at Grafton, IL, in cooperation with the COE, St. Louis District, and on a bimonthly basis at Alton, IL, as part of NASQAN.

4. Suspended-sediment data are being collected eight times a year at Cuivre River near Troy, MO, as part of NASQAN and in cooperation with the Missouri Department of Natural Resources.

Upper Illinois Subregion

1. Suspended-sediment data were collected monthly and more frequently during high flows as part of NAWQA at the following stations:

Illinois River at Marseilles, IL
Des Plaines River at Riverside, IL
Fox River at Dayton, IL
Chicago Sanitary and Ship Canal at Romeoville, IL

2. Suspended-sediment data are being collected on a monthly basis at Illinois River at Marseilles, IL, as a part of NASQAN and NAWQA.

3. Suspended-sediment data were collected on a weekly basis and more often during high flows beginning in November 1992 at the following stations:

Kankakee River at Shelby, IN
Kankakee River at Momence, IL
Kankakee River at Wilmington, IL
Singleton Ditch near Schneider, IN
Iroquois River at Iroquois, IL
Iroquois River near Chebanse, IL

Lower Illinois Subregion

1. Suspended-sediment data were being collected weekly and more frequently during high flows, at Illinois River at Valley City, IL, in cooperation with the COE, St. Louis District. Additional samples are collected on a bimonthly basis at Sangamon River near Oakford, IL, and Spoon River at Seville, IL, as part of the NASQAN program.

Upper Mississippi-Kaskaskia-Meramec Subregion

1. Suspended-sediment data are being collected weekly and more often during high flows, in cooperation with the COE, St. Louis District at the following sites:

Kaskaskia River at Cooks Mills, IL
Kaskaskia River at Venedy Station, IL
Big Muddy River at Murphysboro, IL

2. Suspended-sediment data are being collected on a daily basis at Mississippi River at St. Louis, MO, in cooperation with the COE, St. Louis District.

3. Suspended-sediment data are being collected on a bimonthly basis at Meramac River near Eureka, MO, as part of NASQAN.

4. Suspended-sediment data are being collected on a daily basis at Mississippi River at Chester, IL, in cooperation with the COE, St. Louis District.

5. Suspended-sediment data are being collected on a daily basis at Mississippi River at Thebes, IL, in cooperation with the COE, St. Louis District. Suspended-sediment data also are being collected on a monthly basis in cooperation with the Missouri Department of Natural Resources.

Special Studies

1. Suspended-sediment data are being collected on a daily basis at Blue Earth River near Rapidan, MN, and on a periodic basis at 21 other sites and on a tributary to the Minnesota River. Some bed material also is being collected. The study is a non-point source study within the Minnesota River basin that is being done in cooperation with the Minnesota Pollution Control Agency.

2. Suspended-sediment data were collected every other day, and more frequently during high flows at Big Creek near Bryant, IL, in cooperation with the Metropolitan Sanitary District of Greater Chicago (discontinued December 1986). The sediment data collected were used to monitor changes in sediment transport during the reclamation of a strip-mined area by irrigating with digested sludge from sewage treatment facilities.

Laboratory Activities

The Geological Survey laboratory in Iowa City, IA, analyzed suspended-sediment samples collected by the COE at:

Bay Creek at Nebo, IL
Turkey River at Garbor, IL
Crow Creek at Beltendort, IA
Green River at Geneseo, IL
Wapsipinicon River at DeWitt, IA
Iowa River at Marengo, IA
Iowa River at Coralville Dam, IA
Mississippi River at Burlington, IA
Mississippi River at Keokuk, IA
Des Moines River near Stratford, IA
Raccoon River at Van Meter, IA
North River near Norwalk, IA
Middle River near Indianola, IA
South River near Ackworth, IA
Des Moines River near Tracy, IA
Des Moines River at Keosauqua, IA
Mississippi River at East Dubuque, IL

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

District Chief, WRD
U.S. Geological Survey
Busey County Bank Plaza
102 East Main Street, 4th floor
Urbana, IL 61801

District Chief, WRD
U.S. Geological Survey
5957 Lakeside Boulevard
Indianapolis, IN 46254

District Chief, WRD
U.S. Geological Survey
P.O. Box 1230
Iowa City, IA 52244

District Chief, WRD
U.S. Geological Survey
2280 Woodale Drive
Mounds View, MN 55112

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

District Chief, WRD
U.S. Geological Survey
6417 Normandy Lane
Madison, WI 53719

UPPER MISSISSIPPI (07) REGION

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities.

   a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Mississippi River	Kingston	Cottonwood Drain	Des Moines	IA
Whitewater River	Whitewater	Whitewater	Olmsted, Winona, Wabasha	MN
Illinois River	Peoria Lake	Richland Cr	Woodford	IL
Kaskaskia River	Little Canteen	Little Canteen	St. Clair	IL

2. Reservoir Sedimentation Surveys

Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Schuester	Washington	MN

LOWER MISSISSIPPI REGION

CORPS OF ENGINEERS

Lower Mississippi River Division

Memphis District

Monthly sediment sampling continued at the 15 stations (Established for the purpose of St. Francis River O&M. 8 stations were sampled October through June and 7 stations were sampled during the entire year. Four of these stations maintained daily observations.) previously established in the St. Francis Basin and the station (Established for the purpose of aid in flood control design.) previously established near Colt, Arkansas, in the L'Anguille River Basin. Suspended sediment samplers DH76TM, DH78, D74ALTM and bed sampler BMH60 were used. Records of discharge, observed suspended and bed sediment grain size distribution, observed suspended sediment concentrations, computed suspended sediment load and temperature are maintained.

New Orleans District

Sediment Load Measurements.

1. Suspended sediment and bed material sampling was continued at the following 14 ranges: Mississippi River at Tarbert Landing, MS, biweekly; Mississippi River at Coochie, LA, biweekly; Old River Outflow Channel near Knox Landing, LA, biweekly; Old River Low Sill Structure Outflow Channel, biweekly; Atchafalaya River at Simmesport, LA, biweekly; Old River Auxiliary Structure Outflow Channel, biweekly; Wax Lake Outlet at Calumet, LA, monthly; Lower Atchafalaya River at Morgan City, LA, monthly; Red River above Old River Outflow Channel, biweekly; Atchafalaya Basin, Bayou Chene below Bayou Crook Chene, monthly; Atchafalaya Basin, Lake Long below Bayou La Rompe, monthly; Atchafalaya Basin, Little Tensas below Blind Tensas Cut, monthly; Atchafalaya Basin, East Access Channel above Chicot Pass, monthly; Old River Outflow Channel at Range D-76, biweekly (when Low Sill structure is operated).

2. With the addition of the Vidalia Hydropower station to the Old River Complex, the "Mississippi River at Coochie, LA." range has been relocated 9 miles upstream to river mile 326.2 (Union Point Landing). For the sake of consistency this range will continue to be referred to as Coochie, LA. and will retain the station code 01020. Sampling at this range will continue at biweekly interval. An additional range was established in the Old River Outflow Channel. "Old River Outflow Channel at Range D-76" (station code 02450) is located between the confluences of the Auxiliary outflow channel and Hydropower outflow channel. This range is sampled only when the Low Sill Structure is operated and then at a semimonthly interval.

3. 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.

Sedimentation Surveys. Channel surveys, including hydrographic, topographic and bathymetric ranges were obtained on many streams within the District to measure channel depths and elevation of deposits.

SEDIMENTATION SURVEYS

Drainage Basin or Project	Survey Purpose	Type of Survey	Elements Measured	Equipment Used	Survey Scope	Available Results
Lower Mississippi River						
Bar channel	Shoal study	Hydrographic and topographic ranges	Channel depths	Fathometer, lead line	Elevation of shoal in channel @ 500 ft intervals	Comparative cross-sections Head of Passes to Gulf
Navigation crossings	Shoal study	Hydrographic and topographic ranges	Channel depths	Fathometer, lead line	Elevation of shoal in channel	Detailed surveys of eight river crossings*
Main channel	Channel depths	Hydrographic ranges	Channel depths	Fathometer	Selected ranges District Boundary to Head of Passes	Comparative cross-sections computed widths, depths, areas
Atchafalaya River Basin						
Sedimentation ranges	Hydraulic elements	Topographic ranges	Elevation of deposits	Level, lead line	Sediment deposits at selected ranges	Comparative elevations, and profiles
Main channel	Channel depth	Hydrographic ranges	Channel depths	Fathometer	Selected ranges entire length	Comparative cross-sections Computed widths, depths,
Atchafalaya Bay	Hydraulic elements	Bathymetric and topographic ranges	Elevation of deposits	Fathometer, level	Selected ranges	Bathymetric/topographic map w/contours
Old River Control						
Auxiliary inflow channel	Channel depths	Hydrographic ranges	Channel depths, deposits	Fathometer	Selected ranges entire length	Comparative cross-sections contour plots
Outflow channel	Channel depths	Hydrographic ranges	Channel depths	Fathometer	Selected ranges entire length	Comparative cross-sections computed widths, depths, areas

NOTES: * Crossings: Red Eye, Medora, Granada, Bayou Gouls, Alhambra, Philadelphia, Smoke Bend, Belmont, and Fairview

Office Investigations. The District continues to monitor sediment diversion at the Old River Complex as stipulated in the operational agreement between the Corps and the Vidalia Hydropower Plant partnership. The agreement's guidelines and requirements for the diversion and measurement of sediments by the Hydropower interests continues to be a point of discussion. Efforts continue to establish a procedure for determining annual sediment deficit.

Under the Coastal Wetlands Planning, Protection, and Restoration Act, the District is working with the State of Louisiana and various federal agencies in looking at ways to beneficially use sediments to create and restore coastal wetlands. Proposals include sediment diversions along the Mississippi River, use of pipelines to convey sediments, demonstration projects to look at new methods to effectively place dredge material, and mining offshore sediment for barrier island restoration.

A computer Data Base System is being used to store hydrographic data for the period of record in the District.

The District continues the effort to input historical sediment data to the micro-computer Data Base System for storing, retrieving, and analyzing sediment data.

Bed material samples were collected at 58 locations on the Atchafalaya River at approximately 3-4 mile intervals. These samples are to be compared with historical data to define possible changes in river bed gradation.

St. Louis District

Sedimentation Investigations.

1. The data collected with the first resurvey of the sedimentation ranges at Mark Twain Lake was finalized into report form. The completed report, including higher authority review comments was officially approved in March 1992.

2. The resurveying of selected sedimentation ranges at Lake Wappapello was initiated in late 1992. This data will be used to prepare the Third Report of Sedimentation for the lake. The last survey and report was completed in 1964.

3. A total of 39 underwater dikes, called Bendway Weirs, have been built in four bends of the Middle Mississippi River. These bends are Dogtooth Bend (mile 24.0 to 22.0), Prices Bend (mile 32.0 to 30.0), and Cape Bend (mile 55.0 to 53.8), and Red Rock (mile 95.0 to 93.0). The weirs have been designed to rearrange the velocity distribution and sediment movement within bendways. Prototype data collection has confirmed that they are producing a more efficient navigation channel around the bends. For detailed information contact the Potamology Section of the St. Louis District.

4. The District's Integrated River Management (IRM) program continues to expand. The IRM program attempts to analyze all available data (hydrologic,

sedimentation, past dredging history) to ensure that the most efficient dredging program is developed. The latest technologies (surveying, computer software, etc.) are applied to River and Dredge Engineering studies to ensure that channel maintenance measures such as Bendway Weirs, dike construction, and actual dredging operations are optimized. IRM activities for 1992 included:

a. Initiated construction on a new survey boat which will be equipped with Global Positioning System (GPS) technology, a channel sweep survey system, and the latest computer data and telecommunication systems to make data transfer from the field to office as efficient as technology allows. The boat will be operational in the Spring of 1993.

b. Continued to analyze actual dredge cuts with before, after and monitoring (taken anywhere from 1 week to 3 or more months after dredging) surveys. This data will be analyzed along with other pertinent information such as stage and flow data, sediment load, depth of dredge cut, and width of dredge cut to determine optimum parameters to be considered in dredge cut layout.

c. Developed an extensive statistical analysis of historical river stage data (LoCast) for numerous gages in the District. This data provides confidence levels of probability for the occurrence of river stages at later dates. These forecasts have proven to be very accurate and are utilized as a tool in the decision making process concerning when, where, and how long dredging activities are expected to occur.

d. Initiated development of a Mississippi River Geographic Information System (GIS) to assist in storage, retrieval, and analysis of spatial and tabular data, which includes sediment data. This GIS will be utilized extensively as an IRM tool. Implementation is scheduled to take place in 1993.

5. In November 1992, the District initiated a monitoring program at the site of the new Olmstead Lock and Dam (Lock and Dam 53 on the Ohio River) for the Louisville District. Twenty three ranges were established. Velocity data and depth integrated sediment data are collected at each range. In addition, at three of the ranges bed samples are obtained. The data will be collected on two month intervals and analyzed to monitor changes as construction activities continue.

Sediment Load Measurements. Bi-Monthly sampling (Mar thru Oct) of temperature, turbidity, total solids, suspended solids, dissolved solids were done at the following locations.

1. Cannon Damsite at Hwy A Bridge, Salt River, Missouri. (Station established for the purpose of Mark Twain Lake O&M General.)

2. Lake Shelbyville T.W., Kaskaskia River, Illinois. (Station established for the purpose of Lake Shelbyville O&M General.)

3. Carlyle Dam T.W., Lower Kaskaskia River, Illinois. (Station established for the purpose of Carlyle Lake O&M General.)

4. Below Rend Lake Dam, Big Muddy River, Illinois. (Station established for the purpose of Rend Lake O&M General.)

5. St. Louis Harbor, Mississippi River, Illinois. (Station established for the purpose of St. Louis Harbor Study.)

Vicksburg District

Sedimentation Surveys. Channel surveys, including cross sections and profiles, were obtained on many streams within the District during the year. These data, which are to be used in various hydrologic and hydraulic studies, were collected by surveying existing and new permanent ranges, temporary ranges, and fathometer spot surveys.

Sediment Load Measurements.

1. Both bed sample and suspended sample measurements are being made weekly at three locations on the Mississippi River. These locations are Natchez, MS; Vicksburg, MS; and Arkansas City, AR. Bed material samples are gathered using a BM-54 bed material sampler, and suspended material samples are collected using a P-61 suspended materials sampler.

2. An ongoing program in which the suspended sample, bed material sample, temperature, discharge, and stage data are collected and computerized for many stations within the District has been continued. Bed samples were collected using either BM-54, BMH-60, or drag bucket bed material samplers, while suspended samples were collected using either D-48, D-57, D-61, or D-74 suspended material samplers or by dip sampling.

3. A comprehensive data collection program was completed for Goodwin Creek. This data collection program was completed by the Agricultural Research Service at no cost to the District.

Office Investigations.

1. Red River Waterway.

a. During 1992, the expanded Red River sediment sampling program initiated during 1988 continued. This expanded program is required in order to obtain sufficient sediment data to ensure the effective design of project features. Prior to 1988, suspended sediment samples were taken at random time intervals at Fulton, AR; Shreveport, LA; and Alexandria, LA. The expanded program includes weekly suspended sediment sampling and discharge measurements at Fulton, Shreveport, and Alexandria. Also, suspended sediment samples and discharge measurements are taken biweekly at Spring Bank, AR, and Grand Ecore, LA.

b. During 1992, hinge pool operation studies for Lock and Dam Nos. 4 and 5 continued. These studies are required to determine the most effective hinge pool operation for enhancement of sediment transport within these two pools.

c. During 1991, the TABS-2 numerical model study for the upstream

approach to Lock and Dam No. 5 was completed. The results of this study indicated the need for additional TABS-2 and HEC-6 studies. The HEC-6 studies were initiated in 1992.

2. Demonstration Erosion Control (DEC) Project. The DEC Project is a joint effort between the District and the Soil Conservation Service to reduce flooding, erosion, and sedimentation problems in 15 watersheds in the Yazoo River Basin. Sedimentation related activities ongoing as part of the DEC Project include:

a. Geomorphic and sediment transport studies were continued in 1992 for Pelucia Creek, Black Creek, and Coldwater River watersheds as part of the development of technical work plans for these watersheds. Monitoring and evaluation continued in an effort to quantify sediment yield reductions from the project watersheds as a result of constructed project features.

b. Automatic suspended-sediment sample stations have been installed in 7 of the 15 DEC watersheds. Stations on Batupan Bogue, Otoucalofa Creek, Hickahala Creek, Senatobia Creek, and Hotophia Creek have been operational for approximately 8 years. Stations on Fannegusha Creek, Long Creek, and Harland Creek went into operation in early 1987. Stations on Abiaca Creek were installed during 1991. These are being maintained and operated by U.S. Geological Survey for the District.

3. Upper Yazoo Project Reformation Project. A draft sedimentation analysis report was completed as part of the Upper Yazoo Project Reformation Study.

Southwestern Division

Little Rock District

Sediment sampling continued at Dam No. 2, L&D No. 3, L&D No. 4, L&D No. 5 and David D. Terry L&D on the Arkansas River. Samples were taken intermittently with USD-49 and concentration in terms of the percent of weight were obtained.

LOWER MISSISSIPPI REGION

GEOLOGICAL SURVEY

Lower Mississippi-Hatchie Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Mississippi River at Memphis, TN, Obion River near Obion, TN, and at Hatchie River at Bolivar, TN, as a part of the National Stream Quality Accounting Network (NASQAN).

Lower Mississippi-St. Francis Subregion

1. Suspended-sediment data are being collected on a daily basis at St. Francis River, Saco, MO, in cooperation with COE, St. Louis District.

2. Suspended-sediment data are being collected on a bimonthly basis at St. Francis River at Parkin, AR, and at St. Francis Bay at Riverfront, AR, as a part of NASQAN.

3. Suspended-sediment data are being collected on a bimonthly basis at L'Anguille River near Colt, AR, as part of a State Coop Program.

Lower Mississippi-Yazoo Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Yazoo River at Redwood, MS, and on a quarterly basis at Mississippi River near Arkansas City, AR, as a part of NASQAN.

2. Suspended-sediment data are being collected by an automatic PS-69 pumping sampler at the following sites in cooperation with the Interagency Demonstration Erosion Control Task Force:

Hotopha Creek near Batesville, MS
Otoucalofa Creek near Water Valley, MS
Hickahala Creek near Senatobia, MS
Batupan Bogue at Grenada, MS
Peters (Long) Creek near Pope, MS
Harland Creek near Howard, MS
Abiaca Creek near Seven Pines, MS
Abiaca Creek at Cruger, MS

Lower Red-Ouachita Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Ouachita River at Columbia, LA, and on a quarterly basis at Ouachita River at Camden, AR, as a part of NASQAN. Sediment data are being collected on a quarterly 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 quarterly basis at Tensas River at Tendal, LA, as a part of NASQAN.

Lower Mississippi-Big Black Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Big Black River at Bovina, MS, and quarterly at Homochitto Creek at Rosetta, MS, and Mississippi River at Vicksburg, MS, as part of NASQAN.

Lower Mississippi-Lake Maurepas Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Amite River at Port Vincent LA, Tangipahoa River at Robert, LA, and at Tchefuncta River near Covington, LA, as a part of NASQAN.

Louisiana Coastal Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Bayou Teche at Keystone Lock and Dam below St. Martinville, LA, Mermentau River at Mermentau, LA, and at Calcasieu River near Kinder, LA, and bimonthly at Atchafalaya River at Melville, LA, as a part of NASQAN and in cooperation with the U.S. Army Corps of Engineers (COE).

2. Suspended-sediment data are being collected on a bimonthly basis at Mississippi River at Belle Chasse, LA, as a part of NASQAN.

3. Suspended-sediment data are being collected on a monthly basis at Mississippi River near St. Francisville, LA, in cooperation with the COE.

4. Suspended-sediment and bed-material data are collected at the following sites on a monthly basis in cooperation with the COE:

Lower Atchafalaya River at Morgan City, LA
Wax Lake Outlet at Calumet, LA, as part of NASQAN, and in cooperation with the U.S. Army Corps of Engineers (COE).

5. Suspended-sediment and bed-material data are collected weekly by the COE in the Atchafalaya Basin at Bayou Chene above Bayou Crook Chene, East Access Channel above Lake Chicot, Lake Long below Bayou LaRompe, and Little Tensas Cut.

Special Studies

1. Suspended-sediment data are being collected at 15 stations on the St. Francis River and selected tributaries for the COE. Daily sediment stations are operated at four sites. Eight sites are collected on a monthly basis and the remaining seven sites are collected on a monthly basis from November through June. Monitoring is expected to continue from year to year as the need exists.

2. Suspended-sediment data are being collected on a stormevent basis at six sites in Shelby, Fayette, and Tipton Counties as part of the Beaver Creek pre- and post-best-management-practices comparison study.

Laboratory Activities

The Geological Survey sediment laboratory located in Baton Rouge, LA, analyzed suspended-sediment and bed-material samples collected by the COE at the following locations:

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 Chene above Bayou Crook Chene
East Access Channel above Lake Chicot
Lake Long below Bayou LaRompe
Little Tensas below Blind Tensas Cut
Old River Low Sill Structure Outflow Channel
Old River Auxillary Structure Outflow Channel
Amite River at selected sites.

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
Baton Rouge, LA 70896

District Chief, WRD
U.S. Geological Survey
Suite 710, Federal Building
100 West Capitol Street
Jackson, MS 39269

District Chief, WRD
U.S. Geological Survey
810 Broadway, Suite 500
Nashville, TN, 37203

LOWER MISSISSIPPI (08) REGION

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities.

a. Public Law-566

Major Drainage	Watershed	Stream	County	State
St. Francis River	Big Slough	Big Slough	Clay, Greene	AR
Pearl River	Sellers Creek	Sellers Creek	Simpson	MS

b. Public Law-534

Major Drainage	Watershed	Stream	County	State
Tallahatchie River	Long Creek	Long Creek Caney Creek Bobo Creek Hurt Creek Johnson Creek	Panola	MS
Tallahatchie River	Toby Tubby	Toby Tubby	Lafayette	MS
Tallahatchie River	Arkabutla	Arkabutla	Tate, Panola	MS
Tallahatchie River	Strayhorn	Strayhorn	Tate, Panola	MS
Tallahatchie River	S. Tillatoba	S. Tillatoba Yalobusha Grenada	Tallahatchie	MS
Tallahatchie River	N. Tillatoba	N. Tillatoba	Tallahatchie	MS
Tallahatchie River	Potacocowa	Potacocowa	Carroll Grenada	MS
Tallahatchie River	McIvor	McIvor	Panola	MS

SOURIS-RED-RAINY REGION

GEOLOGICAL SURVEY

Souris Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Souris River near Westhope, ND, as part of the National Stream Quality Accounting Network (NASQAN).

Red Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Sheyenne River at Kindred, ND, and Red River at the north at Halstad, MN, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Beaver Creek near Finley, ND, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a bimonthly basis at the Red River of the North at Emerson, Manitoba, Canada, as part of NASQAN.

4. Suspended-sediment data are being collected on a bimonthly basis at the Red Lake River at Crookston, MN, and quarterly at Roseau River below State Ditch 51 near Caribou, MN, as a part of NASQAN.

5. Samples of freshly-deposited, fine-grained bottom-sediment were collected from 23 stream sites throughout the Red River of the North basin during August-September as part of the National Water Quality Assessment (NAWQA) program. The samples were field sieved and sent to the USGS Central Laboratory for analysis. The bottom sediment samples will be analyzed to determine the concentrations of a large suite of hydrophobic organic chemicals and a large number of minor elements.

Rainy Subregion

1. Suspended-sediment data were collected on a quarterly basis at Kawishiwi River near Ely, MN, as part of the National Hydrologic Benchmark Network, and on a bimonthly basis at Rainy River at Manitou Rapids, MN, as part of NASQAN.

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

District Chief, WRD
U.S. Geological Survey
2280 Woodale Drive
Mounds View, MN 55112

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

SOURIS-RED-RAINY (09) REGION

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities:

   a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Red River	Renwick	Tongue River	Pembina	ND
Red River	Mt. Carmel	Little S. Pembina	Cavalier	ND

2. Reservoir Sedimentation Surveys

Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Mt. Carmel	Cavalier	ND

MISSOURI REGION

Bureau of Reclamation

Heart Butte Reservoir - Data collection for a range line reservoir sediment survey at Heart Butte Reservoir near Glen Ullin, North Dakota was conducted during August and September 1992. Rangeline soundings were done at reservoir elevation 2049 feet. A revised area and capacity table for the reservoir will be prepared from this data.

MISSOURI BASIN REGION

CORPS OF ENGINEERS

Missouri River Division

Kansas City District

Sediment Load Measurements. The District is operating three Missouri River stations and two inflow stations to Harry S. Truman Reservoir. The Missouri District of the United States Geological Survey (USGS) collects monthly points, depth integrated, and bed samples on the main stem of the Missouri River at St. Joseph, Kansas City, and Herman, Missouri. The Missouri USGS hires observers to collect daily depth integrated samples on the Osage River at Schell City, Missouri and South Grand River at Clinton, Missouri. Sand gradations for Missouri River materials and total concentrations for other stations are performed at the USGS laboratory located in Rolla, Missouri.

Lake and Reservoir Sediment Activities.

1. Harry S. Truman Reservoir. The impoundment was closed in July 1977 and filled to multipurpose pool level in November 1979. The initial resurvey was scheduled for FY 1986, but funding was not available until FY 1992. Initially, 53 multipurpose and flood pool ranges were authorized, but in order to define the many facets of the local geometry, several additional line of sight hydrographic soundings were made at selected sites. These additional ranges were extended from the reservoir surface to high ground by utilizing the reservoir topographic maps. All of the permanent range monuments have been tied to the Western Grid of the Missouri State plane coordinate system using satellite GPS. Additionally, degradation ranges below Pomme de Terre Lake and Stockton Lake, which are within the HST pool, were also surveyed. In all, over 119 ranges were surveyed to define the reservoir geometry. Because of the large surface area, length of the reservoir, and the many large tributaries, over two weeks were required to collect 85 statistical representative samples of the accumulated deposits. Sample specific weights and material size distributions were performed by the Missouri River Division Laboratory.

2. Tuttle Creek Lake. A resurvey of this lake has been initiated and will be completed in 1993.

3. Stockton Lake. Springfield, Missouri is negotiating with this District for additional water supply and Planning Division ask for a breakdown of expected delta formation for this lake. The 1987 resurvey was used to determine the basin yields for various tributaries and based upon these data expected delta formations were determined.

4. Smithville Lake. The multipurpose pool was lowered about 4 feet for embankment repair during the fall of 1992. The event yielded an opportunity to survey the perimeter of the multipurpose pool and assess the amount and extent of bank erosion and beaching. Maps were marked, photos were taken, and numerous measurements were made to compare with the recently surveyed range lines. This reconnaissance was conducted to supplement the quantified volume of displaced bank materials as measured from the hydrographic soundings. This information will be presented in the Smithville Lake Sedimentation report.

Special Studies.

1. Missouri River Data Base. For several years, this District has contracted with the Missouri District of the USGS to compile a PC data base which will include all the historical and current sediment information collected at St. Joseph, Kansas City, and Hermann, Missouri. The data base should allow multi-parameter interrogation for making data analyses.

2. Kansas River. Since 1968, this District has attempted to regulate the dredging industry operating on the Kansas River in order to minimize the channel degradation, tributary headcutting, overall channel widening, and other directly related degradation activities that have been occurring over an even longer period. On 1 January 1992, the commercial dredging industry began operating under a Regulatory Plan developed by the District's River and Lake Engineering Section. This Plan controls the amount of dredged material by setting allowable degradation limit that can occur over given reaches of the river. Under the Plan, the Kansas River Dredging Association (KRDA) will provide this office with various river data which will enable us to evaluate the dredging industry's compliance with the established criteria to limit degradation and bank widening in established reaches of the river.

3. Lake of the Ozarks. A monitoring program instituted in 1979 below Harry S. Truman Project is being continued. Due to turbine repair problems over the past few years, the emphasis of this program has been lower in priority. Flood evacuations are being monitored at selected sites when applicable for thalweg velocity distributions and sediment concentrations. Eleven bank erosion sites are being surveyed annually for changes in the banklines and channel. Analyses of the thalweg data collected to date indicate that peaking power production transports approximately 4 times the amount of suspended material than does an equivalent volume released over a 24-hour period. Peaking power discharges also generate higher channel velocities at the lower monitoring sites. The retreat of the scarped banks when projected along the present beaching line will require some 15 to 25 years before total beaching occurs.

4. Republican River Basin.

(1) Republican River. From the mouth to 6.0 miles above the confluence, considerable degradation has been noted, especially in the local area of the Junction City, Kansas water-works location. The city hired a consulting firm to perform a study concerning the effects the lowering river water surface over years has had over the local aquifer. The consultant reported a general lowering of 8.0 feet in the lower reach of the Republican River. To verify this magnitude, since the District's data did not support this result, a water surface profile and thalweg survey was performed. The first 6 degradation ranges were surveyed which covered a distance above the mouth of 5.5 miles. The data indicated that some 5.0 feet of thalweg deepening has occurred in an incised low flow channel. Based on previous surveys, most of this lowering has occurred since 1980. Because of low inflows into Milford Lake over the past few years, releases have also been low and a meandering low flow channel has developed within the main channel. The main channel has had a significant growth of vegetation occurring over this same period. This preliminary study was extended to the gauge at Fort Riley, Kansas, approximately 1.4 miles below the confluence of the Republican and Smokey Hill Rivers. The stage-discharge relationships at this gauge was

reviewed for changes in stage over time for a flow of 500 cfs. Gauge data indicate that for a flow of 500 cfs, the stage in 1967 was 5.9 feet and in 1987, the stage was 4.2 feet. Field measurements indicate a stage of 4.0 in 1990 for 500 cfs. About 2.0 feet of lowering has occurred since 1967 for this magnitude of flow. Copies of all USGS field measurement notes for the Fort Riley, Kansas gauge have been acquired and are being examined to reconstruct the channel geometry prior to construction of Milford Lake.

(2) Milford Lake. A sizeable delta has accumulated above a major crossing at Wakefield, Kansas. Several proposals have been given to the District by the State of Kansas and other private entities to develop a wetland in the area upstream of the crossing. The proposal is to construct some type of control structures at or near the bridge to further control the water levels. These groups would like to utilize this area for water-fowl attraction and wetland development to recycle inflowing contaminants and nutrients. Several preliminary studies have been conducted for the Planning Division concerning the use of this area and its possible use for these purposes.

(3) Harlan County Lake. Because of low pool elevations due to irrigation demands, the aggradation ranges and base maps were heavily used to identify water surface areas for various projected low pool elevations. A considerable amount of this data was used for making decisions for allowing the pool to be lowered by the Bureau of Reclamation to meet irrigation demands.

5. Sac River below Stockton Lake. The Sac River bank lines are continuing to be mapped as time permits from Stockton Dam to the mouth. Low altitude photography is being used to make overlays of the original base maps that were used for taking the initial erosion easements. In several places, the banklines have moved well beyond the easement take line.

6. Blue River Channel Improvement Project near Kansas City. Physical model studies were analyzed to determine the magnitude of the pressure differentials around several bridge piers for the Hydrology and Hydraulics Section. This study was undertaken to find a solution for the concrete slab failures and displacement that occurred during a runoff event in the recently completed reach of the project. The runoff event was considerably less than the design discharge for this project.

Omaha District

Special Studies.

1. Buford-Trenton Irrigation District. Historic and existing data (piezometer, precipitation, river stage, etc.) associated with the groundwater table at the Buford-Trenton Irrigation District, just upstream of Lake Sakakawea near Williston, north Dakota, were examined and a report prepared. Rising Missouri River stages, a result of aggradation and the delta formation in Lake Sakakawea, have raised the water table in the irrigation district as much as four to six feet, possibly impacting crop production and flooding some basements. This analysis was performed in support of a reconnaissance study of the Buford-Trenton area documenting all aggradation-related problems and exploring potential solutions.

2. Lake Sakakawea Shoreline Erosion Report. MRD Sediment Series Number 38 entitled "Bank Recession, Causes, Measurement Techniques, Rates, and Predictions, Lake Sakakawea, North Dakota" was completed by Dr. John Reid of the University of North Dakota, in cooperation with the Omaha District. This report is a compilation of data and analyses from previous studies by Dr. Reid and the Omaha District to define the causes of shoreline erosion and measure and document erosion rates. A regression equation for predicting erosion on Lake Sakakawea is also presented.

3. Shoreline Erosion Assessment-Garrison Creek and Pick City Cabin Areas, Lake Sakakawea. 100-year shoreline erosion limit lines developed in 1982 at the Garrison Cottage Area and in 1969 at the Pick City #1 Cabin Area were reviewed. This review included a check of the analysis procedures used and the impacts of updated wind-wave analysis.

4. Washburn, North Dakota, Water Intake. Field data, historic sediment rangeline data, and aerial photographs were used to analyze and document the characteristics and morphology of the Missouri River near Washburn, North Dakota. This analysis was undertaken to determine the cause of the sedimentation problem at Washburn's water supply intake structure and to assess potential sedimentation impacts to suggested engineering solutions.

5. Lake Sharpe, LeFramboise Island. Sedimentation problems in the boat channel downstream of LeFramboise Island were examined. This preliminary investigation included a field reconnaissance survey, looked for the source of the sediments depositing in the channel, and explored possible solutions to the problem.

6. Big Bend Dam Relief Wells. Sedimentation just below Big Bend Dam was analyzed, based on aggradation bed surveys for Lake Francis Case (1954-1986). A forecast of future sedimentation rates was made to facilitate the determination of new design invert elevations for rehabilitating or replacing the dam's relief well outfall pipes.

7. Lake Sharpe Area-Capacity Tables. The area-capacity tables for Lake Sharpe were updated using 1991 survey data.

8. Lake Francis Case, Proposed Marina Sites. Five potential marina sites on Lake Francis Case in South Dakota were evaluated for potential adverse sedimentation impacts. This evaluation consisted of assessments of existing and future sediment deposition problems from tributary aggradation and littoral drift (restricting boating access) as well as possible shoreline erosion impacts. Field data collected included cross sections and longitudinal profiles.

9. Pipestem Lake Area-Capacity Tables. The area-capacity tables for Pipestem Lake near Jamestown, North Dakota were updated using 1990-1992 survey data.

10. Burt and Washington Counties, Nebraska, Section 205. A reconnaissance level investigation of sediment yields from the Missouri River bluff creeks adjacent to the Burt-Washington Drainage District was completed in support of the subject Section 205 study. The use of settling basins to decrease the amount of sediment depositing in the District's ditches was also examined.

11. Little Sioux River. Cross section data, velocity and discharge measurements, and habitat data were collected at the confluence of the Little Sioux River and the Missouri River in Iowa. The data was used in support of the Environmental Impact Statement (EIS) for the Missouri River Water Control Master Manual.

12. Little Sioux River Hydrographic Surveys. Forty cross sections were surveyed from Sill No. 4 upstream to the confluence of the Maple River at the Little Sioux River in Iowa. The purpose of the data was to document upstream aggradation trends at the project.

13. Welsh Landfill, Pennsylvania. The Universal Soil Loss and Modified Universal Soil Loss equations were used to predict the long term soil loss and the sediment yield for a 25-year storm event, respectively, at this Superfund landfill site.

Sediment Load Measurements. The Omaha District maintained eight suspended sediment sampling stations during the year. Four are Missouri River stations (Landusky, Montana; Sioux City, Iowa; Omaha, Nebraska; and Nebraska City, Nebraska) and four are major tributary stations (the Musselshell River at Mosby, Montana; the Yellowstone River at Sidney, Montana; the Bad River at Fort Pierre, South Dakota; and the White River at Oacoma, South Dakota). The U.S. Geological Survey monitors, computes, and publishes sediment load records at these stations under a cooperative stream gaging program.

Aggradation/Degradation Reach Groundwater Measurements. As a result of complaints and legal claims against the government, stemming from aggradation or degradation effects on groundwater levels adjacent to privately owned lands, several observation wells have been placed along the Missouri River in the major aggradation and degradation reaches. These wells are being used to monitor the degree of impact over time. All records are obtained either by the U.S.G.S. or by contract observers, and the data entered into a HEC Data Storage System data base by District personnel.

1. Fort Peck Project. Four wells were read bi-monthly immediately downstream of Fort Peck Dam. Data from these wells were used for the Fort Peck Additional Hydropower Study, and will be used in the future to assess relationships between river stages and groundwater levels.

2. Yellowstone Confluence. Sixteen wells are located in the vicinity of the confluence of the Missouri and Yellowstone Rivers (only 13 of these wells are currently read due to the landowner refusing access). These wells are used to monitor the effect of Missouri and Yellowstone River stage increases on local groundwater levels. They were read bi-weekly during the irrigation season and monthly for the remainder of the year, with the exception of December and January, when no readings are taken.

3. Buford-Trenton Irrigation District. Twelve wells were read, nine monthly and three quarterly, to monitor the effect of Missouri River stage increases on local groundwater levels. Data from these wells are currently being used to assess aggradation impacts on groundwater levels in the area.

4. Garrison Project. Four wells are located immediately downstream of Garrison Dam. They were read bi-monthly and will be used to assess

relationships between river stages and groundwater levels.

5. Bismarck, North Dakota. Prior to 1992, nine groundwater wells in the Bismarck vicinity were read quarterly by the U.S. Geological Survey. Readings for these wells were discontinued; however, the wells will be maintained indefinitely should the need to re-establish readings occur.

6. Pierre, South Dakota. Data from eleven observation wells are used to monitor groundwater levels in a residential area as well as to predict the ground water levels associated with aggradation. Readings are taken monthly.

7. Fort Randall Project. Four wells were read weekly upstream of the Niobrara township on the Missouri River. Data from these wells are used to monitor the ground water impacts of aggradation in the Missouri River.

8. Niobrara River. Four observation wells were read weekly to monitor groundwater changes associated with lake headwater aggradation effects in Lewis and Clark Lake and the effects of delta growth at the mouth of the Niobrara River.

Reservoir Sediment Activities.

1. Monument Maintenance below Fort Peck Dam. Forty-seven (47) sediment rangelines were located between Fort Peck Dam and the mouth of the Yellowstone River in Montana. Maintenance included repainting witness markers and replacing those monuments and witness markers lost or vandalized beyond repair.

2. Garrison Dam Spillway Approach Channel Survey. Underwater cross sections were surveyed at the spillway approach channel at Garrison Dam in North Dakota. The data was used to construct a bed contour map that will be used to determine the reduction of flow capacity due to sediment accumulation in the spillway approach channel.

3. Water Surface Profile below Garrison Dam. Missouri River water surface elevations were measured from Garrison Dam, North Dakota to the mouth of the Cannonball River during two days of steady releases. This survey was made at the request of the Missouri River Division Reservoir Control Center MRD-RCC).

4. Lake Oahe Master Plan Reconnaissance. Eighteen (18) recreation sites located along upper Lake Oahe between Bismarck, North Dakota and Mobridge, South Dakota were inspected in order to document sedimentation, littoral drifting, and bank erosion concerns that may impact each site. The data will be used to update the Upper Lake Oahe Master Plan.

5. White River Reconnaissance Survey. Reconnaissance hydrographic surveys were conducted at the confluence of the White River and Lake Francis Case near Chamberlain, South Dakota. The purpose of this survey was to define the boundaries of the White River delta which, during the annual pool drawdown in October, creates two separate Lake Francis Case pools for a short period with an approximately five foot difference in water surface elevations.

6. Monument Maintenance at Lewis and Clark Lake. Twenty-two sedimert rangelines were located and maintenance completed on monuments and witness posts at the upper reach of Lewis and Clark Lake along the Nebraska - South Dakota border.

7. Upper Lewis and Clark Lake Hydrographic Surveys. Twenty-two sediment rangelines were surveyed and a water surface profile was measured at the upper reach of Lewis and Clark Lake along the Nebraska - South Dakota border. The data was used by MRD-RCC to update a streamflow model used to determine the proper discharge from Fort Randall Dam needed to support nesting least terns and plovers (both are threatened and endangered species).

8. Terns and Plovers Islands. Temporary benchmarks were established at seven manmade islands that were created as nesting areas for least terns and plovers in the Missouri River near Springfield, South Dakota.

MISSOURI REGION

GEOLOGICAL SURVEY

Saskatchewan Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at St. Mary's River at Montana, USA-Alberta, Canada, border, as a part of the National Stream Quality Accounting Network (NASQAN).

Missouri-Marias Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Missouri River at Toston, MT, and bimonthly at Sun River near Vaughn, MT, as a part of NASQAN.

Missouri-Musselshell Subregion

1. Suspended-sediment data are being collected on a daily basis at Missouri River near Landusky, MT, and at Musselshell River at Mosby, MT, in cooperation with the U.S. Army Corps of Engineers (COE).

Milk Subregion

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

2. Suspended-sediment data are being collected on a quarterly basis at Rock Creek below Horse Creek near the international boundary, as a part of the National Hydrologic Benchmark Network and quarterly at Lodge Pole Creek at Lodge Pole and Little Peoples Creek near Hays, in cooperation with the Fort Belknap Reservation.

Missouri-Poplar Subregion

1. Suspended-sediment data are being collected on a bimonthly basis in cooperation with Montana Department of Natural Resources at the following sites to define water-quality characteristics of the Poplar River basin:

    Poplar River at international boundary
    East Poplar River at international boundary
    East Fork Poplar River near Scobey, MT

2. Suspended-sediment data are being collected on a bimonthly basis at Poplar River near Poplar, MT, as a part of NASQAN.

3. Suspended-sediment data are being collected on a quarterly basis at Beaver Creek at international boundary as part of the Water Ways Treaty Program.

Missouri-Madison Subregion

1. Suspended-sediment data are being collected 7 times a year in cooperation with the U.S. Bureau of Reclamation, Missouri River Basin (MRB) study at:

    Madison River near West Yellowstone
    Madison River below Hebgen Lake, near Grayling
    Madison River below Ennis Lake, near McAllister

Upper Yellowstone Subregion

1. Suspended-sediment data are being collected on a daily basis April through September at the Yellowstone River at Corwin Springs, MT, and at the Lamar River near Tower Falls Ranger Station, Yellowstone National Park, in cooperation with the National Park Service

2. Suspended-sediment data are being collected on a bimonthly basis at Yellowstone River near Livingston, MT, and quarterly at Yellowstone River at Billings, MT, as part of NASQAN.

Big Horn Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Bighorn River at Bighorn, MT, as a part of NASQAN.

2. Suspended-sediment data are being collected on a 6-week and storm-event basis at Bighorn River at Kane, WY, as a part of the Missouri River basin program.

3. Suspended-sediment data and bed-load are being collected on an event basis for the nonwinter season at Wind River above Bull Lake Creek near Crowheart, Wind River near Crowheart, and Wind River near Kinnear, WY, as part of the Missouri River basin program.

4. Suspended-sediment data are being collected on a daily basis at Wind River at Riverton, and Wind River above Boysen Reservoir near Shoshoni, WY, in cooperation with the Wyoming State Engineer and as part of NASQAN.

5. Suspended-sediment data are being collected on a hydrograph basis at Baldwin Creek below Dickinson Creek at Lander, WY, Little Wind River near Riverton, WY, Bighorn River at Lucerne, WY, Bighorn River near Basin, WY, Greybull River near Basin, WY, Shoshone River near Lovell, WY, and Fifteen mile Creek near Worland, WY, in cooperation with the Wyoming Department of Environmental Quality.

6. Suspended-sediment data are being collected on a hydrograph basis at Squaw Creek at Smith Street, Landor, WY, in cooperation with the Wyoming Department of Agriculture.

7. Suspended-sediment data are being collected on a daily basis for the non-winter season at Jones Creek at mouth, near Pahaska, WY, and Crow Creek at mouth, at Pahaska, WY, in cooperation with the U.S. Forest Service and the Wyoming Department of Environmental Quality, and as part of the Federal program.

Powder-Tongue Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Tongue River at Miles City, MT, and a bimonthly basis at Powder River at Locate, MT, as a part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis March through September at Powder River at Moorhead, MT, and at Powder River at Broadus, MT, as part of the National Research Program.

3. Suspended-sediment data are being collected on a hydrograph basis at Big Goose Creek near Sheridan, WY, Little Goose Creek at Sheridan, WY, Goose Creek below Sheridan, WY, and Crazy Woman Creek at upper station, near Arvada, WY, in cooperation with the Wyoming Department of Environmental Quality.

4. Suspended-sediment data are being collected 9 times a year at Tongue River at Tongue River Dam and quarterly at Hanging Woman Creek near Birney, MT, and Otter Creek at Ashland, MT, in cooperation with the U.S. Bureau of Land Management.

Lower Yellowstone Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Armells Creek near Forsyth, MT, and Rosebud Creek at mouth near Rosebud, MT, in cooperation with the U.S. Bureau of Land Management.

2. Suspended-sediment data are being collected daily during runoff and approximately weekly during non-runoff conditions at Cherry Creek at Terry, MT, in cooperation with the Bureau of Land Management.

3. Suspended-sediment data are being collected on a daily basis at Yellowstone River near Sidney, MT, in cooperation with the COE.

Missouri-Little Missouri Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Bear Den Creek near Mandaree, ND, as part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a quarterly basis at Little Missouri River near Watford City, ND, as part of NASQAN.

Missouri-Oahe Subregion

1. Suspended-sediment data is being collected on a quarterly basis at Knife River at Hazen, ND, at Heart River near Mandan, ND, and at Cannonball River at Breien, ND, as a part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at Moreau River near Whitehorse, SD, as a part of NASQAN.

Missouri-Cheyenne Subregion

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

2. Suspended-sediment data are being collected on a hydrograph basis at Little Thunder Creek near Hampshire, WY, as part of the Missouri River basin program.

3. Suspended-sediment data are being collected on a 6-week and storm-event basis in cooperation with the city of Gillette, WY, at Stonepile Creek at Gillette, WY.

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

5. Suspended-sediment data are being collected on a bimonthly basis at Belle Fourche River below Moorcroft, WY, as part of NASQAN.

6. Suspended-sediment data are being collected on a monthly basis at Whitewood Creek above Whitewood, SD, and Whitewood Creek above Vale, SD, in cooperation with the South Dakota Department of Environment and Natural Resources.

Missouri-White Subregion

1. Suspended-sediment data are being collected on a daily basis at South Fork Bad River near Cottonwood, SD, Plum Creek below Hayes, SD, Bad River near Fort Pierre, SD, and White River near Oacoma, SD, in cooperation with North Central RC&D and the COE.

2. Suspended-sediment data are being collected six times per year on a periodic basis at Little White River above Rosebud, SD, in cooperation with the U.S. Bureau of Indian Affairs, Rosebud Sioux.

Missouri-Andes Creek Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Andes Creek near Armour, SD, Lake Andes Tributary No. 1 near Lake Andes, SD, Lake Andes Tributary No. 2 near Lake Andes, SD, and Lake Andes Tributary No. 3 near Armour, SD, in cooperation with the USBR and as part of the Missouri River basin program.

Missouri-Choteau Creek Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Choteau Creek near Wagner, SD, and Choteau Creek near Dante, SD, in cooperation with the USBR.

Niobrara Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Niobrara River near Verdel, NE, as a part of NASQAN.

Missouri-James Subregion

1. Suspended-sediment data are being collected on a periodic basis at James River at LaMoure, ND, James River at Pingree, ND, and James River near Ludden, ND, as part of the Missouri River Basin program.

2. Suspended-sediment data are being collected on a periodic basis at James River near Manfred, ND, James River near Grace City, ND, James River above Arrowhead Lake near Kensal, ND, James River at Jamestown, ND, and James River at Oakes, ND, as part of the Garrison Diversion Refuge Monitoring Program.

3. Suspended-sediment data are being collected on a bimonthly basis at James River near Columbia, SD, as a part of NASQAN, and the Missouri River basin program.

4. Suspended-sediment data are being collected on a quarterly basis at James River near Scotland, SD, as part of NASQAN.

5. Suspended-sediment data are being collected on a periodic basis at James River at Columbia, SD, in cooperation with the U.S.Bureau of Reclamation.

Missouri-Big Sioux Subregion

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

North Platte Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at North Platte River near Lisco, NE, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Encampment River above Hog Park Creek near Encampment, WY, Encampment River above East Fork Encampment River near Encampment, and East Fork Encampment River at mouth near Encampment, WY, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a bimonthly basis at North Platte River above Seminoe Reservoir, near Sinclair, WY, as part of NASQAN.

4. Suspended-sediment data are being collected on a hydrograph basis at Laramie River near Bosler, WY, in cooperation with the Wyoming Department of Environmental Quality.

South Platte Subregion

1. Suspended-sediment data are being collected on a quarterly basis at South Platte River at Julesburg, CO, and bimonthly at South Platte at Henderson, CO, as a part of NASQAN.

2. Suspended-sediment data are being collected monthly at North Fork Cache La Poudre River at Livermore, CO.

Platte Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Platte River at Louisville, NE, as a part of NASQAN.

2. Suspended-sediment data are being collected on a bimonthly basis at Platte River near Duncan, NE, as part of NASQAN.

3. Suspended-sediment data are being collected on a flow-event basis at up to 10 sites in the Platte River basin as a part of the Central Nebraska Basins NAWQA.

Loup Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Cedar River near Fullerton, NE, as part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Dismal River near Thedford, NE, as part of the National Hydrologic Benchmark Network.

Elkhorn Subregion

1. Suspended-sediment data are being collected at Elkhorn River at Waterloo, NE, on a bimonthly basis as a part of NASQAN.

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 COE, Omaha District:

Missouri River at Sioux City, IA
Missouri River at Omaha, NE
Missouri River at Nebraska City, NE

Missouri-Nishnabotna Subregion

1. Suspended-sediment data are being collected on a daily basis at Nodaway River at Clarinda, IA, in cooperation with the Iowa Department of Natural Resources, Geological Survey Bureau.

2. Suspended-sediment data are being collected on a quarterly basis at Nishnabotna River above Hamburg, IA, as a part of NASQAN.

3. Suspended-sediment data are being collected on a quarterly basis at Platte River at Sharps Station, MO, as a part of NASQAN.

4. Suspended-sediment data are being collected on a monthly basis at Missouri River at St. Joseph, MO, in cooperation with the Missouri Department of Natural Resources. Sediment data, which includes bed material, suspended-sediment samples, and velocities at several points in a vertical, are being collected periodically at the Missouri River at St. Joseph, MO, and Kansas City, MO, in cooperation with COE, Kansas City District.

Republican Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Republican River near Clay Center, KS, as part of NASQAN.

Smoky Hill Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at South Fork Solomon River at Osborne, KS, and Smoky Hill River at Enterprise, KS, as part of NASQAN.

Kansas Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Big Blue River at Barneston, NE, as part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at West Fork Big Blue River near Dorchester, NE, as part of the Federal CBR program.

3. Suspended-sediment data are being collected on a quarterly basis at Kings Creek near Manhattan, KS, as part of the National Hydrologic Benchmark Network.

Chariton-Grand Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Elk Creek near Decatur City, IA, 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, as a part of NASQAN, and in cooperation with the Missouri Department of Natural Resources.

Gasconade-Osage Subregion

1. Suspended-sediment data are being collected on a daily basis in cooperation with the COE, Kansas City District at the following locations:

Osage River above Schell City, MO
South Grand River at Clinton, MO

2. Suspended-sediment data are being collected on a monthly basis at Osage River below St. Thomas, MO, and at Osage River above Schell City, MO, as a part of NASQAN.

3. Suspended-sediment data are being collected on a monthly basis at Gasconade River near Jerome, MO, as a part of NASQAN, and in cooperation with the Missouri Department of Natural Resources.

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, and in cooperation with the Missouri Department of Natural Resources. Sediment data, which includes bed material, suspended-sediment samples, and velocities at several points in a vertical, are being collected periodically in cooperation with COE, Kansas City District.

Special Studies

1. PS-69 pumping sediment samplers are operating at Lower Hay Creek Tributary near Wilbaux, MT, discontinued September 30, 1981, and at West Branch Antelope Creek Tributary No. 4 near Zap, ND, 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
Bldg. 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225

District Chief, WRD
U.S. Geological Survey
P.O. Box 1230
Iowa City, IA 52244

District Chief, WRD
U.S. Geological Survey
4821 Quail Crest Place
Lawrence, KS 66049

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

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 428
301 South Park Ave., Drawer 10076
Helena, MT 59626

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

District Chief, WRD
U.S. Geological Survey
2617 Lincolnway, Suite B
Cheyenne, WY 82001

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

District Chief, WRD
U.S. Geological Survey
1608 Mt. View Road
Rapid City, SD 57702

MISSOURI BASIN (10) REGION

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities.

   a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Missouri River	E. Fork Grand	E. Fork	Harrison	MO
			Worth	MO
			Ringgold	IA
			Union	IA
Missouri River	Taylor	Knife River	Stark/Dunn	ND
Nemaha	Turkey Creek	Turkey Creek	Pawnee	NE
			Johnson	NE
			Nemaha	NE
Platte	Rock Creek	Rock Creek	Saunders	NE
			Lancaster	NE
Platte	Wahoo Creek	Wahoo Creek	Saunders	NE
Platte	Stevens Creek	Stevens Creek	Lancaster	NE

Missouri: Sedimentation and erosion investigations were completed on the above watershed with detail sufficient for a PL-566 Watershed Plan. These investigations included: floodplain damage assessments, permanent and ephemeral gully evaluations, stream stability interpretations, and sheet and rill erosion calculations. All data have been analyzed and are currently being incorporated into the plan. The plan is scheduled for completion in 1993.

   b. River Basin Investigations

Major Drainage	Watershed	Stream	County	State
Missouri River	Flat Creek	Flat Cr	Franklin	MO
Platte	Yankee Hill (AGNPS)			NE
Platte	Wildwood (AGNPS)			NE
Elkhorn	Taylor Creek (AGNPS)			NE
Statewide	Nebraska Watershed Evaluation Cooperative River Basin Study			NE

Missouri: Sedimentation and erosion investigations were completed on the above watershed with detail sufficient for a Floodplain Management Study. These investigations included: floodplain damage assessments, permanent and ephemeral gully evaluations, stream stability interpretations, and sheet-and-rill erosion calculations. All data have been analyzed and the final report has been completed.

2. Reservoir Sedimentation Surveys

Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Rothwell Lake	Randolph	MO

Missouri: A brief report was prepared regarding data collected during a reservoir sedimentation survey on Rothwell Lake, Moberly, Randolph County, Missouri. The purpose of the survey was to determine the present storage capacity, the original capacity at the time of construction, and the volume of sediment that has been deposited in the lake. The survey was conducted at the request of the City of Moberly, Missouri. The information is to be incorporated in a clean lakes study to be prepared by the U.S. Environmental Protection Agency and the Missouri Department of Natural Resources.

3. Special Studies

Major Drainage	Watershed	Stream	County	State
Missouri River	Mormon Fork	Mormon Fork	Bates, Cass	MO
Missouri River	Post Oak Cr.	Post Oak Cr.	Johnson	MO
Missouri River	Town Branch	Town Branch	Warren	MO

Missouri: Reconnaissance investigations were conducted on the above watersheds in preparation for future PL-566 studies. Particular attention was given to erosion, sedimentation, and general geology.

North Dakota: West Missouri River Basin Study continued in 1992.

Kansas: "Northeast Kansas Erosion and Sediment Yield Report" published in January 1993. The report estimates the sediment yield from sheet and rill, ephemeral gully, streambank, and flood plain scour by land use by hydrologic units in eight northeast counties.

Nebraska:

A. Response was made to a congressional inquiry on sedimentation issues associated with the Gering Drain project in Western Nebraska.

B. Four-state planning session on channel stability issues in the Loess Hills Region along the Missouri River (sponsored by the Golden Hills RC&D, Iowa).

C. Guidelines were developed for the water quality incentive program for ACP cost-sharing. Topics included sheet and rill erosion, concentrated flow and channel erosion.

E. The sedimentation geologist gave a presentation to the Nebraska Dam Safety Seminar on erosion, sedimentation, and reservoir storage requirements.

ARKANSAS - WHITE - RED REGION

Bureau of Reclamation

Upper Arkansas River - In June 1992, bedload samples were collected at three sites during snowmelt runoff on the Arkansas River near Leadville, Colorado, and analyzed for heavy metal concentration and size distribution. Bedload discharge for the measured flows was also computed. This sampling was part of a program related to mine water treatment and related problems in the Arkansas River Basin.

ARKANSAS-WHITE-RED REGION

CORPS OF ENGINEERS

Southwestern Division

Albuquerque District

Sediment Load Measurements. Suspended sediment load measurements were made at two stations (Arkansas River below John Martin Reservoir, CO., and Purgatoire River below Trinidad Lake near Trinidad, CO.) in the region. They are obtained for O&M purposes.

Other Investigations. Trinidad and John Martin Dams continued to be operated to control sediment in the Arkansas River Basin.

Little Rock District

Sedimentation Surveys. Sediment ranges were surveyed in Dardanelle and Ozark Lakes and in Pools 2, 3, 4, and 5 of the Arkansas River.

Sediment Load Measurements. Thirty Sediment samples were obtained on Arkansas River, Mulberry, Spadra Creek, Little Piney Creek, Piney Creek, Petit Jean, Fourche La Fave, White River, Taylor Bay, James River, Bryant Creek, North Fork, Current River, Black River, Piney Fork, Strawberry River, Little Red River. Samples were taken monthly to daily, or intermittently and the concentration in percent of weight records were maintained.

Tulsa District

Sedimentation Surveys. A detailed sedimentation resurvey was completed on Pearson-Skubitz Big Hill Lake, Kansas. Reconnaissance hydrographic resurveys were conducted on Fort Supply Lake, Oklahoma, John Redmond Reservoir and Elk City Lake, Kansas. Other reconnaissance surveys were initiated on Canton and Eufaula Lakes, Oklahoma, and the work on these two lakes will be completed during FY 93. Hydrographic survey was performed on the Walnut River at Arkansas City, Kansas. Contour maps were developed from this survey for use in determining channel realignment and dredge quantity information. Hydrographic surveys were performed on Bardwell, Navarro Mills, Wright Patman and Somerville Lakes, Texas, for the Fort Worth District.

Sediment Load Measurements. The suspended sediment sampling program consisted of 38 operational stations with 34 stations in the Arkansas River Basin and 4 stations in the Red River Basin. Samplers DH-48, DH-49 were used and records of suspended sediment concentration and conductivity were maintained.

Arkansas River Basin	Arkansas Riv	at Arkansas City, KS
		Haskell,OK
		Kaw Dam
		Ralston, OK
		Tulsa, OK
	Beaver Riv	Guymon,OK

Arkansas River Basin	Big Hill Cr	at	Cherryvale, KS
	Bird Cr		Sperry, OK
	Black Bear Cr		Pawnee, OK
	Canadian Riv		Calvin, OK
	Caney Riv		Ramona, OK
	Cimarron Riv		Perkins, OK
	Cottonwood Riv		Marion, KS
			Plymouth, KS
	Deep Fork Riv		Arcadia, OK
			Beggs, OK
			Warwick, OK
	Elk Riv		Elk Falls, KS
	Grand (Neosho) Riv		Americus, KS
			Commerce, OK
	Hominy Cr		Skiatook, OK
	Illinois Riv		Tahlequah, OK
	Little Ark Riv		Valley Center, KS
	N. Canadian Riv		Oklahoma City, KS
	N. Canadian (Beaver) Riv		Selling, OK
	Otter Cr		Climax, KS
	Salt Fork, Ark Riv		Alva, OK
			Jet, OK
	Verdigris Riv		Claremore, OK
			Lenapah, OK
	Walnut Riv		Winfield, KS
	Whitewater Riv		Towanda, KS
Red River Basin	Beaver Cr	at	Waurika, OK
	Red Riv		Dekalb, TX
	Washita Riv		Dickson, OK
	Middle Pease Riv		Paducah, TX

Other Investigations. The Reservoir Sediment Data Summaries (ENG Form 1787) for the detailed resurveys of the following lakes (dates of survey in parentheses) have been completed and forwarded to Southwestern Division: Pearson-Skubitz Big Hill Lake, Kansas (1992) and Pat Mayse Lake, Texas (1984). Reservoir Sediment Data Summaries for reconnaissance resurveys of the following lakes also have been completed and forwarded to Southwestern Division: Fall River Lake, Kansas (1990) and John Redmond Reservoir, Kansas (1991). Sediment estimates and projections are performed as required.

ARKANSAS-WHITE-RED REGION

GEOLOGICAL SURVEY

Upper White Subregion

1. Suspended-sediment data are being collected bimonthly at White River at Calico Rock, AR, as part of the State Coop Program.

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

3. Suspended-sediment data are being collected on a bimonthly basis at White River at Newport, AR, as a part of the National Stream Quality Accounting Network (NASQAN).

4. Suspended-sediment data are being collected bimonthly at Black River at Black Rock, AR, as part of the State Coop Program.

Upper Arkansas Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Arkansas River at Portland, CO, as part of NASQAN.

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

3. Suspended-sediment data are being collected on a daily basis at the following stations, in cooperation with the U.S. Army, Fort Carson, CO:

Purgatoire River near Thatcher, CO
Taylor Arroyo below Rock Crossing near Thatcher, CO
Chacauco Creek at mouth near Timpas, CO
Purgatoire River at Rock Crossing near Timpas, CO

4. Suspended-sediment data are being collected on a daily basis, approximately 6 months of the year, at Badger Creek upper station near Howard, CO, and Badger Creek lower station near Howard, CO, in cooperation with the U.S. Bureau of Land Management.

5. Suspended-sediment data are being collected on a periodic basis at the following stations, in cooperation with the city of Colorado Springs:

Fountain Creek near Colorado Springs, CO
Fountain Creek at Colorado Springs, CO
Fountain Creek at Secrity, CO

6. Study is being performed to determine what metals are being transported on the sediments and in solution in the Leadville, CO, area.

7. Suspended-sediment data are being collected nine times per year at 12 gaging stations on the Arkansas River and Fountain Creek.

Middle Arkansas Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Arkansas River near Coolidge, KS, as part of NASQAN.

2. Suspended-sediment data are being collected on a 6-week or periodic basis at Little Arkansas River at Valley Center, KS, Arkansas River at Arkansas City, KS, Whitewater River at Towanda, KS, and Walnut River at Winfield, KS, in cooperation with the U.S. Army Corps of Engineers (COE).

Lower Cimarron Subregion

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

2. Suspended-sediment data are being collected at Cimarron River at Perkins, OK, in cooperation with the COE and as a part of NASQAN.

Arkansas-Keystone Subregion

1. Suspended-sediment data are being collected at Arkansas River near Ponca City, OK, Salt Fork Arkansas River near Jet, OK, Salt Fork Arkansas River at Alva, OK, Black Bear Creek at Pawnee, OK, and Arkansas River near Haskell, OK, in cooperation with the COE.

2. Suspended-sediment data are being collected at Arkansas River at Ralston, OK, as a part of NASQAN and in cooperation with the COE.

Neosho-Verdigris Subregion

1. Suspended-sediment data are being collected on a 6-week or periodic basis at the following sites in cooperation with the COE:

Otter Creek at Climax, KS
Elk River at Elk Falls, KS
Big Hill Creek near Cherryvale, KS
Neosho River at Council Grove, KS
Neosho River near Americus, KS
Cottonwood River below Marion Lake, KS (Discontinued September 30, 1992)
Cottonwood River near Plymouth, KS

2. Suspended-sediment data are being collected at Neosho River near Parsons, KS, and Neosho River below Fort Gibson Lake near Fort Gibson, OK, as a part of NASQAN.

3. Suspended-sediment data are being collected on a periodic basis at the following sites in cooperation with the COE:

Verdigris River near Lenapah, OK
Verdigris River near Claremore, OK
Birch Creek below Birch Lake near Barnsdall, OK
Bird Creek near Sperry, OK
Neosho River near Commerce, OK

4. Suspended-sediment data are being collected at Caney River near Ramona, OK, as a part of NASQAN and in cooperation with the COE.

Upper Canadian Subregion

1. Suspended-sediment data are being collected at the following stations at this indicated frequency in cooperation with the New Mexico Interstate Stream Commission:

Cimarron River near Cimarron, NM (semiannual)
Ponil Creek near Cimarron, NM (bimonthly)
Rayado Creek near Cimarron, NM (bimonthly)
Mora River at La Cueva, NM (bimonthly)
Ute Reservoir near Logan, NM (annual)

2. Suspended-sediment data are being collected on a bimonthly basis at the Canadian River near Sanchez, NM, in conjunction with the Water Quality Surveillance Program in cooperation with the New Mexico Interstate Stream Commission and as part of NASQAN.

Lower Canadian Subregion

1. Suspended-sediment data are being collected at Canadian River near Canadian, TX, as part of NASQAN.

2. Suspended-sediment data are being collected at Canadian River at Calvin, OK, as a part of NASQAN and in cooperation with the COE.

North Canadian Subregion

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

2. Suspended-sediment data are being collected at the following sites in cooperation with the COE:

Beaver River near Guymon, OK
North Canadian River near Seiling, OK
North Canadian River below Lake Overholser near Oklahoma City, OK
Deep Fork near Arcadia, OK
Deep Fork near Warwick, OK

4. Suspended-sediment data are being collected at Deep Fork near Beggs, OK, for NASQAN and in cooperation with the COE.

Lower White Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Cache River at Patterson, AR, as part of a State Coop Program.

2. Suspended-sediment data are being collected bimonthly at Bayou DeView at Morton, AR, as part of the State Coop Program.

Lower Arkansas Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Arkansas River at James W. Trimble Lock and Dam near Van Buren, AR, and at Arkansas River at David D. Terry Lock and Dam below Little Rock, AR, as a part of NASQAN.

2. Suspended-sediment data are being collected at Illinois River near Tahlequah, OK, in cooperation with the COE.

3. Suspended-sediment data are being collected at Arkansas River at Tulsa, OK, in cooperation with the COE and as a part of NASQAN.

Red Headwaters Subregions

1. Suspended-sediment data are being collected periodically at North Fork Red River near Headrick, OK, at Salt Fork Red River near Elmer, OK, and at Prairie Dog Town Red River near Wayside, TX, as a part of NASQAN.

Red-Washita Subregion

1. Suspended-sediment data are being collected periodically at Red River near Burkburnett, TX, at Red River at Denison Dam near Denison, TX (discontinued September 1986), and at Red River near Gainesville, TX (discontinued September 1986), as a part of NASQAN.

2. Suspended-sediment data are being collected at Washita River near Dickson, OK, in cooperation with the COE and as a part of NASQAN.

3. Suspended-sediment data are being collected on a periodic basis at the following sites in cooperation with the COE:

Red River near Quanah, TX (Discontinued 12/31/90)
North Wichita River near Truscott, TX (Discontinued 12/31/90)
Red River near DeKalb, TX
Beaver Creek near Waurika, OK
Middle Pease River, Paducah, TX

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

Red-Sulphur Subregion

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

2. Suspended-sediment data are being collected bimonthly at Red River at Index, AR, as a part of NASQAN.

3. Suspended-sediment data are being collected on a bimonthly basis at Cossatot River near Vandervoort, AR, as part of the National Hydrologic Benchmark Network.

4. Suspended-sediment data are being collected on a quarterly basis at Twelve-mile Bayou near Dixie, LA, and Red River at Alexandria, LA, as a part of NASQAN.

Special Studies

Daily suspended-sediment samples were collected at Cache River at Patterson from January 7 - June 30, 1992, for the Corps of Engineers Waterways Experiment Station. Monitoring is expected to continue for 1993 water year.

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
Baton Rouge, LA 70896

District Chief, WRD
U.S. Geological Survey
Broadway Executive Park
202 N.W. 66th, Building 7
Oklahoma City, OK 73116

District Chief, WRD
U.S. Geological Survey
Building 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225

District Chief, WRD
U.S. Geological Survey
4821 Quail Crest Place
Lawrence, KS 66049

District Chief, WRD
U.S. Geological Survey
4501 Indian School Road, NE
Suite 200, Pinetree Office Park
Albuquerque, NM 87110

District Chief, WRD
U.S. Geological Survey
8011 Cameron Road
Austin, TX 78754

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities.

    a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Red River	Lower Deep Red Run	Deep Red, Brush, Santag, Dry Red	Cotton, Tillman	OK
Red River	Red Run	Deep Red, Little Deep Red, Horse, Deadman	Tillman, Camanche, Kiowa	OK
Red River	Lower Elk	Little Elk, Elk	Washita	Ok
Red River	Cow Creek	Cow, East Cow, Dry	Stephens, Jefferson	OK
Red River	Big Creek	Big	McClain, Garvin, Ponotoc	OK
Red River	Walters	Walters	Cotton	OK
Arkansas River	Broken Arrow	Broken Arrow	Wagoner, Tulsa	OK
Arkansas River	Yellow Water	Yellow Water	Wagoner	OK

TEXAS GULF REGION

Bureau of Reclamation

Falcon Reservoir - A bathymetric resurvey of Falcon Reservoir on the Rio Grande in Texas was performed between May 4 and May 13 of 1992 between reservoir elevations 302.04 and 302.48. The survey was at the request of the International Boundary and Water Commission (IBWC). The task included the resurvey of 74 previously established range lines. The bathymetric collection crew was composed of IBWC and Bureau of Reclamation personal. The above water data was collected by IBWC personal. The collected data was forwarded to the IBWC for analysis and development of the revised area and capacity table.

TEXAS-GULF REGION

CORPS OF ENGINEERS

Southwestern Division

Fort Worth District

Sedimentation Surveys. Sedimentation activities in the District for the calendar year 1992 are as listed below.

1. Reconnaissance survey of Bardwell Lake during the period May 18-23, 1992.

2. Reconnaissance survey of Navarro Mills Lake during the period July 20-25, 1992.

3. Reconnaissance survey of Wright-Patman Lake during the period September 1-3, 1992.

4. Sedimentation resurvey of Somerville Lake during period October 1991 through October 1992.

Galveston District

A total of 362 in-place samples were obtained from navigation projects. These samples were analyzed to determine the quality of the sediment relative to chemical constituents which would be resuspended during dredging, disposal activities, and construction. The projects sampled and number of samples taken are as follows:

Navigation Project	Number of Samples
Gulf Intracoastal Waterway	110
Houston-Galveston Navigation channel	106
Freeport Harbor	71
Brazos Island Harbor	22
Houston Ship Channel	23
Sabine-Neches Waterway	10
Texas City Channel	12
Galveston Harbor	8
Total	362

Surveyed cross-sections are established for the Langham Creek diversion channel in Addicks Reservoir. Survey cross sections are also established for Mason Creek diversion channel, Cinco Ranch diversion channel, and Buffalo Bayou in Barker Reservoir. Staff gages were placed to monitor sediment deposition. A resurvey of all of the above cross sections is planned for FY 93 provided adequate funds are available for both reservoirs.

TEXAS-GULF REGION

GEOLOGICAL SURVEY

Sabine Subregion

1. Suspended-sediment data are being collected at Sabine River near Ruliff, TX, as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are being collected on a daily basis at Big Sandy Creek near Big Sandy, TX, in cooperation with the U.S. Bureau of Reclamation (USBR) beginning October 1, 1984 (discontinued September 1986).

Neches Subregion

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

Trinity Subregion

1. Suspended-sediment data are being collected on a periodic basis at Mountain Creek near Cedar Hill, TX, Duck Creek near Garland, TX, and at Kings Creek near Kaufman, TX, as a part of the Federal Collection of Basic Records (CBR) program (discontinued September 30, 1982).

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

3. Suspended-sediment data are being collected on a periodic basis at Trinity River at Romayor, TX, and at Chocolate Bayou near Alvin, TX (discontinued September 1986), as a part of NASQAN.

4. Suspended-sediment data are being collected on a daily basis at Bedias Creek near Madisonville, TX, in cooperation with the USBR (discontinued September 1986).

Galveston Bay-San Jacinto Subregion

1. Suspended-sediment data are being collected on a periodic basis at West Fork San Jacinto River near Conroe, TX, and at Buffalo Bayou at West Belt Dr., Houston, TX (discontinued September 1986), as part of NASQAN.

2. Suspended-sediment data are being collected on a storm-event basis at Cypress Creek near Westfield, TX, in cooperation with the U.S. Army Corps of Engineers, Galveston, beginning October 1, 1986.

Middle Brazos Subregion

1. Suspended-sediment data are being collected on a periodic basis at Salt Fork Brazos River near Aspermont, TX, Double Mountain Fork Brazos River near Aspermont, TX, Brazos River near Highbank, TX, and at Brazos River near South Bend, TX, as a part of NASQAN.

Lower Brazos Subregion

1. Suspended-sediment data are being collected on a daily and periodic basis at Brazos River at Richmond, TX, as part of the Federal CBR program and also as part of NASQAN (daily sampling discontinued September 1986).

2. Suspended-sediment data are being collected four times a year at South Fork Rocky Creek near Briggs, TX, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected on a periodic basis at Little River near Cameron, TX, as a part of NASQAN.

Upper Colorado Subregion

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

Lower Colorado-San Bernard Coastal Subregion

1. Suspended-sediment data are being collected on a periodic basis at Colorado River at Austin, TX, Colorado River at Wharton, TX, Colorado River near San Saba, TX, and at San Bernard River near Boling, TX (discontinued September 1986), as a part of NASQAN. The collection of suspended-sediment data at Llano River at Llano, TX (discontinued September 1986) began April 1, 1979, as part of NASQAN.

2. Suspended-sediment data for total-load determination is being collected on a periodic basis at Colorado River above Columbus, TX, in cooperation with the Lower Colorado River Authority beginning October 1, 1982 (discontinued September 1986).

Central Texas Coastal Subregion

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

Nueces-Southwestern Texas Coastal Subregion

1. Suspended-sediment data are being collected on a periodic basis at Nueces River near Three Rivers, TX, as a part of NASQAN.

2. Suspended-sediment data are being collected on a storm-event basis as part of a basin study at the following stations, in cooperation with the Soil Conservation Service.

Seco Creek Reservoir near Utopia, TX
Seco Creek at Rowe Ranch D'Hanis, TX
Parker Creek Reservoir near D'Hanis, TX
Seco Creek near Yancey, TX

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

District Chief, WRD
U.S. Geological Survey
8011 Cameron Road
Austin, TX 78754

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities.

   a. River Basin Investigations

Major Drainage	Watershed	Stream	County	State
Colorado River	Lower Colorado	Colorado	Blanco, Gillespie, Kerr, Kimble, Llano, Mason, San Saba	TX

RIO GRANDE REGION

Bureau of Reclamation

Ute Reservoir Resurvey - A bathymetric resurvey of Ute Reservoir on the Canadian River in New Mexico was completed in November, 1992 at elevation 3784.3. The survey was at the request of the New Mexico Interstate Stream Commission. The 1992 study determined that the reservoir has a storage capacity of 244,957 acre-feet and a surface area of 8,047 acres at spillway crest elevation 3787.0. Since closure in December 1962, the reservoir has accumulated a volume of 27,809 acre-feet of sediment below elevation 3787.0. This represents a 10.2-percent loss in total capacity and average annual accumulation rate of 930 acre-feet for the 29.9-year period of operation.

Middle Rio Grande River - A photogrammetric survey of the Rio Grande River from Cochiti Dam down to the upper end of Elephant Butte Reservoir was flown in February. Established range lines were digitized. An analysis of the aggradation or degradation as compared to previous surveys has begun.

RIO GRANDE REGION

CORPS OF ENGINEERS

Southwestern Division

Albuquerque District

Sedimentation Resurveys. New elevation-area-capacity tables for Cochiti Lake and Jemez Canyon Reservoir were adopted in January 1992. The sediment survey reports for each of these projects were submitted to Southwestern Division for approval in March 1992.

Sediment Load Measurements. Suspended sediment measurements were made at four stations in the Rio Grande Region. These stations are located on Rio Chama above Abiquiu Dam, below Abiquiu Dam; on Rio Grande below Cochiti Lake; on Jemez River below Jemez Canyon Dam. All samples are secured by the DH-48, DH-59 or DH-49 samplers according to flow conditions. Samples are not usually accrued on weekends and holidays.

Other Investigations. Abiquiu, Cochiti, Galisteo, and Jemez Canyon Dams continued to be 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 bimonthly basis at Rio Grande near Lobatos, CO, as a part of the National Stream Quality Accounting Network (NASQAN).

Rio Grande-Elephant Butte Subregion

1. Suspended-sediment data are being collected at the following stations at this indicated frequency in cooperation with the New Mexico Interstate Stream Commission:

Rio Hondo near Valdez, NM (bimonthly)
Rio Pueblo De Taos below Los Cordovas, NM (bimonthly)
Rio Chama near La Puente, NM (bimonthly)
Rio Grande below Taos Junction Bridge near Taos, NM (quarterly)

2. Suspended-sediment data are being collected at the following stations at this indicated frequency in cooperation with the Bureau of Indian Affairs:

Rio Chama near Chamita, NM (quarterly)
Rio Grande at Santa Clara, NM (quarterly)

3. Suspended-sediment data are being collected on a daily basis at Rio Grande at Otowi Bridge near San Ildefonso, NM, and at Rio Grande near Albuquerque, NM, as a part of the Federal Collection of Basic Records (CBR) program.

4. Suspended-sediment data are being collected on a daily basis at Rio Puerco above Arroyo Chico near Guadalupe, NM, and at Rio Puerco near Bernardo, NM, in cooperation with the U.S. Bureau of Land Management (BLM), NMISC, and U.S. Army Corps of Engineers (COE).

5. Suspended-sediment data are being collected on a bimonthly basis at Rio Grande at San Felipe, NM, Rio San Jose near Grants, NM, and at Rio Grande at Isleta, NM, in conjunction with the Water Quality Surveillance Program and financed cooperatively by NMISC.

6. Suspended-sediment data are being collected at Santa Fe River above Cochiti Dam, NM (semiannually), Cochiti Lake, NM (annually), and Jemez River near Jemez, NM (semiannually), in cooperation with the NMISC.

7. Suspended-sediment data are being collected on a daily basis at Rio Grande near Bernardo, NM, at Rio Grande at San Acacia, NM, and at Rio Grande at San Marcial, NM, in cooperation with NMISC.

8. Suspended-sediment data for total-load determinations are being collected on a monthly basis at Rio Grande at Albuquerque, NM, at Rio Grande near Bernardo, NM, at Rio Grande at San Acacia, NM, and Rio Grande at San Marcial, NM, in cooperation with NMISC and U.S. Bureau of Reclamation (USBR).

9. Suspended-sediment data are being collected on a quarterly and storm-event basis at Rio Mora near Terrero, NM, as a part of the National Hydrologic Benchmark Network.

10. Suspended-sediment data are being collected on a bimonthly basis at Pecos River above Santa Rosa Lake, NM, and Pecos River near Acme, NM, in cooperation with NMISC.

11. Suspended-sediment data are being collected on a daily basis at Pecos River near Artesia, NM, as part of the Federal CBR program.

12. Suspended-sediment data were collected on a bimonthly basis at Pecos River near Puerto de Luna, NM, in conjunction with the Water Quality Surveillance Program and in cooperation with NMISC.

13. Suspended-sediment data are being collected on a bimonthly basis at Pecos River at Red Bluff, NM, at Rio Grande at El Paso, TX, and at Rio Grande at Fort Quitman, TX, as a part of NASQAN.

Rio Grande-Amistad Subregion

1. Suspended-sediment data are being collected on a periodic basis at Rio Grande at Foster Ranch, near Langtry, TX, and at Devils River at Pafford Crossing, near Comstock, TX, as a part of NASQAN and was changed to a Hydrologic Benchmark Station on October 1, 1986.

Rio Grande Closed Basins Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Rio Tularosa near Bent, NM, as a part of NASQAN.

Lower Pecos Subregion

1. Suspended-sediment data are being collected on a periodic basis at Pecos River near Langtry, TX, as a part of NASQAN.

Lower Rio Grande Subregion

1. Suspended-sediment data are being collected on a periodic basis at Rio Grande River near Brownsville, TX, and at Arroyo Colorado at Harlingen, TX (started October 1, 1986), as part of NASQAN.

2. Suspended-sediment data are being collected on a weekly or more frequent basis at North Floodway near Sebastion, TX, and at Arroyo Colorado Floodway at El Fuste Siphon, south of Mercedes, TX, as part of the Federal CBR program (discontinued September 30, 1983).

Special Studies

A water-quality monitoring plan for the Rio Grande and Red River in Taos County, NM, was initiated in October 1978 by the BLM. The study objectives are to monitor long-term changes in water quality (chemical and sediment) at 12 selected sampling sites. BLM personnel collect monthly samples and the Geological Survey analyzes the samples and publishes the data.

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

District Chief, WRD
U.S. Geological Survey
Bldg. 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225

District Chief, WRD
U.S. Geological Survey
4501 Indian School Road, NE
Suite 200, Pinetree Office Park
Albuquerque, NM 87110

District Chief, WRD
U.S. Geological Survey
8011 Cameron Road
Austin, TX 78754

RIO GRANDE (13) REGION

SOIL CONSERVATION SERVICE

1. Reservoir Sedimentation Surveys

Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Prop Canyon #1	Cibola	NM

UPPER COLORADO REGION

Bureau of Reclamation

Durango Pumping Plant - A petrographic examination of river sand samples from the Las Animas River upstream of the Durango Pumping Plant, Colorado was performed. The mineralogical composition and estimated volume percentages, shape parameters, and the gradation data for the sand-sized fraction of the sample indicated high potential for pump wear due to the presence of about 60 to 65 percent quartz, 20 to 25 percent feldspar, 5 to 10 percent illite/mica, and 2 to 3 percent calcite. The weighted average Moh's hardness for the sand-sized fraction of the sample is about 6 and for the fines fraction, minus 75 μm, is about 5.

UPPER COLORADO REGION

GEOLOGICAL SURVEY

Colorado Headwaters Subregion

1. Suspended-sediment data are being collected on a once-a-week basis at Colorado River near Cameo, CO, in cooperation with the Colorado River Water Conservation District.

2. Suspended-sediment data are being collected on a bimonthly basis at Colorado River near Colorado-Utah State line as a part of the National Stream Quality Accounting Network (NASQAN).

3. Suspended-sediment and bedload data are being collected on a daily basis, April through September at Muddy Creek above Antelope Creek near Kremmling, CO, in cooperation with the Colorado River Water Conservation District.

4. Suspended-sediment data are being collected periodically from April through September at Muddy Creek at Kremmling, CO, in cooperation with the Colorado River Water Conservation District.

Gunnison Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Gunnison River near Grand Junction, CO, as a part of NASQAN.

Upper Colorado-Dolores Subregion

1. Suspended-sediment data are being collected on a bimonthly basis level at Colorado River near Cisco, UT, as part of NASQAN.

2. Suspended-sediment data are being collected on a bimonthly basis at Dolores River near Cisco, UT, as a part of NASQAN.

Great Divide-Upper Green Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Green River near La Barge, WY, as part of NASQAN.

2. Suspended-sediment data are being collected on a daily basis at Green River near Green River, WY, as a part of the Federal Collection of Basic Records Program. (Discontinued September 30, 1992)

3. Suspended-sediment data are being collected on a hydrograph basis at Dry Piney Creek near Big Piney, WY, Big Sandy River at Gasson bridge near Eden, WY, and Bitter Creek above Killpecker Creek near Rock Springs, WY, in cooperation with the Wyoming Department of Environmental Quality.

White-Yampa Subregion

1. Suspended-sediment data were obtained once a week at Yampa River near Maybell, CO, in cooperation with the Colorado River Water Conservation District.

2. Suspended-sediment data are being collected on a hydrograph basis at Little Snake River below Baggs, WY, in cooperation with the Wyoming Department of Environmental Quality.

3. Suspended-sediment data are being collected quarterly at several stations in the Piceance Creek basin to monitor the potential impact of oil shale development.

Piceance Creek above Hunter Creek near Rio Blanco, CO
Piceance Creek below Rio Blanco, CO
Piceance Creek tributary near Rio Blanco, CO
Piceance Creek above Ryan Gulch, CO
Stewart Gulch above West Fork near Rio Blanco, CO
Willow Creek near Rio Blanco, CO
Piceance Creek near White River, CO
Corral Gulch near Rangely, CO
Yellow Creek at White River, CO

These stations are operated in cooperation with Rio Blanco County.

4. Suspended-sediment data are collected periodically at Sand Wash near Sunbeam, CO, in cooperation with the Bureau of Land Management.

5. Suspended-sediment data are collected on a periodic basis at White River below Boise Creek near Rangely, CO.

Lower Green Subregion

1. Suspended-sediment data are being collected on a monthly basis at San Rafael River near Green River, UT, in cooperation with the U.S. Bureau of Reclamation (USBR).

2. Suspended-sediment data are being collected on a bimonthly basis at Green River at Green River, UT, as part of NASQAN.

Upper Colorado-Dirty Devil Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Colorado River at Lees Ferry, AZ, as part of NASQAN and in cooperation with the Arizona Department of Environmental Quality.

San Juan Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Vallecito Creek near Bayfield, CO, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a daily basis at Animas River at Farmington, NM, as a part of NASQAN, and Animas River at Cedar Hill, NM, on a quarterly basis, in cooperation with NMISC.

3. Suspended-sediment data are being collected on a quarterly basis at San Juan River at Shiprock, NM, as a part of NASQAN.

4. Suspended-sediment data are being collected on a quarterly basis at San Juan River near Bluff, UT, as part of NASQAN.

5. Suspended-sediment data are being collected on a monthly basis at Montezuma Creek near Bluff, UT, in cooperation with the U.S. Bureau of Land Management and the Soil Conservation Service.

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

District Chief, WRD
U.S. Geological Survey
375 South Euclid Avenue
Tucson, AZ 85719

District Chief, WRD
U.S. Geological Survey
4501 Indian School Road, NE
Suite 200, Pinetree Office Park
Albuquerque, NM 87110

District Chief, WRD
U.S. Geological Survey
2617 E. Lincolnway, Suite B
Cheyenne, WY 82001

District Chief, WRD
U.S. Geological Survey
Bldg. 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225

District Chief, WRD
U.S. Geological Survey
Room 1016 Administration Building
1745 West 1700 South
Salt Lake City, UT 84104

UPPER COLORADO (14) REGION

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities.

    a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Muddy Creek	Muddy Creek	Muddy Creek	Kane	UT

This is an ongoing joint effort between the Soil Conservation Service and the Bureau of Land Management to determine sediment and salt yields resulting from excess overland flows, rills, gullies, and streambanks. An environmental impact statement concerning treatment of the watershed will be prepared in 1993.

2. Special Studies

Upper Colorado River Rangeland Salinity Control Project has involved evaluating rangeland watersheds throughout the Colorado River Basin in Utah to quantify nonpoint source sediment and salt yields which eventually impact water quality of the Colorado River system. The report describing the character and procedures of the project is completed. Sagers Wash Watershed report is completed. Five other watershed reports are in progress with completion due this spring. A USGS Water Supply Paper about the project will be published.

LOWER COLORADO REGION

Bureau of Reclamation

Bartlett Dam - A streambed erosion analysis for the Verde River borrow area found minimal scour impacts due to the limited impact area and small volume of excavation.

Many Farms Dam - An analysis of the local scour potential at the proposed spillway over Dike B-C showed a potential scour of 14 feet for high spillway flows.

LOWER COLORADO REGION

GEOLOGICAL SURVEY

Lower Colorado-Lake Mead Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at the following sites as part of the National Stream Quality Accounting Network (NASQAN):

Virgin River at Littlefield, AZ
Muddy River above Lake Mead near Overton, NV

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

Pahranagat Wash near Moapa, NV
Meadow Valley Wash near Rox, NV
Las Vegas Wash above detention basin near N. Las Vegas, NV

3. Suspended-sediment, bedload, and total-load data are being collected on a regular and storm-event basis at Virgin River at Mesquite, NV, Virgin River at Riverside, NV, and Virgin River at Littlefield, NV. This is in cooperation with the Las Vegas Valley Water District. Three automatic samplers were in place collecting point-sediment data at the three sites. Supplemental suspended-sediment sampling is planned at two to three other sites.

Little Colorado Subregion

1. Suspended-sediment data are being collected when instantaneous discharge exceed 50-cubic feet per second in cooperation with the U.S. Corps of Engineers (COE) at Little Colorado River near Joseph City, AZ.

2. Suspended-sediment data are being collected on a flow-event basis at Leroux Wash near Holbrook, AZ, in cooperation with the COE.

3. Suspended-sediment data are being collected on a bimonthly basis at Zuni River above Black Rock Res., NM, and Rio Nutria near Ramah, NM, in cooperation with the U.S. Bureau of Indian Affairs (BIA).

Lower Colorado Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Bill Williams near Planet, AZ, in cooperation with the U.S. Bureau of Reclamation (USBR), the COE, and the city of Scottsdale, AZ.

2. Suspended-sediment data are being collected five times a year as part of NASQAN at Colorado River below Hoover Dam, AZ-NV.

3. Suspended-sediment data are being collected monthly on the Central Arizona Project (CAP) Canal at MP 162.3 at 7th Street at Phoenix, AZ, and at CAP Canal above Brady Powerplant near Coolidge, AZ, and quarterly at the CAP Canal below the Havasu Pumping Plant at Parker, AZ, in cooperation with the Arizona Department of Environmental Quality.

4. Suspended-sediment data are being collected monthly at Colorado River at NIB above Morelos Dam near Andrade, CA, as part of NASQAN, and in cooperation with the Arizona Department of Environmental Quality.

Upper Gila Subregion

1. Suspended-sediment data are being collected on a quarterly and storm-event basis at Mongollon Creek near Cliff, NM, as a part of the National Hydrologic Benchwork Network.

2. Suspended-sediment data are being collected on a bimonthly basis at Gila River near Redrock, NM, as part of NASQAN.

3. Suspended-sediment data are being collected on a bimonthly basis at the San Francisco River near Clifton, AZ, and at Gila River at head of Safford Valley, near Solomon, AZ, in cooperation with the Arizona Department of Environmental Quality.

4. Suspended-sediment data are being collected on a quarterly basis at Gila River at Calva, AZ, as a part of NASQAN and the Arizona Department of Environmental Quality.

Middle Gila Subregion

1. Suspended-sediment data are being collected on a monthly basis at the San Pedro River at Charleston, AZ, as a part of NASQAN, and in cooperation with the Arizona Department of Environmental Quality.

2. Suspended-sediment and bed-material data are being collected on a bimonthly basis at Gila River at Kelvin, AZ, and on a monthly basis at San Pedro River below Aravaipa Creek near Mammoth, AZ, in cooperation with the USBR. Bed material data are also collected twice annually at San Pedro River below Aravaipa Creek near Mammoth, AZ under this program.

Lower Gila Subregion

1. Suspended-sediment data are being collected in cooperation with the USBR on a monthly basis at Agua Fria River near Rock Springs, AZ, and on a bimonthly basis at Agua Fria River below Lake Pleasant, AZ, during releases from Waddell Dam.

2. Suspended-sediment data are being collected on a monthly basis as a part of NASQAN and in cooperation with the Arizona Department of Environmental Quality at Gila River above diversions at Gillespie Dam, AZ.

Salt Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Wet Bottom Creek near Childs, AZ, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a monthly basis as a part of NASQAN and in cooperation with the Arizona Department of Environmental Quality at:

Salt River near Roosevelt, AZ
Verde River below Tangle Creek, AZ

3. Suspended-sediment data are being collected on a bimonthly basis in cooperation with the Arizona Department of Environmental Quality at:

East Verde River near Childs, AZ
Pinal Creek at Inspiration Dam near Globe, AZ
Salt River below Stewart Mountain Dam, AZ
Verde River below Bartlett Dam, AZ

4. Suspended-sediment data are being collected on a monthly basis in cooperation with the Arizona Department of Environmental Quality at:

Verde River near Clarkdale, AZ
Oak Creek at Redrock Crossing, AZ
Verde River near Camp Verde, AZ

Special Studies

1. Suspended-sediment samples are being collected on a flow-event basis as part of an ongoing study to collect baseline water-quality information on the Rillito Creek and tributaries prior to construction for a recharge demonstration project. Sample sites are:

Alamo Wash at Tucson, AZ
Pantano Wash at Broadway Boulevard at Tucson, AZ
Tanque Verde Creek at Tucson, AZ
Rillito Creel at Dodge Boulevard at Tucson, AZ

2. A long-term, ongoing statewide program in Nevada of investigations of sediment and debris transported by flash floods continued during 1989.

3. Suspended-sediment and bed material samples are collected approximately bimonthly at the following stations:

Colorado River at Lees Ferry, AZ
Colorado River above Little Colorado River near Desert View, AZ
Colorado River near Grand Canyon, AZ
Colorado River above National Canyon near Supai, AZ
Colorado River above Diamond Creek near Peach Springs, AZ

4. Suspended-sediment data are collected on a flow-event basis at:

Paria River at Lees Ferry, AZ
Kanab Creek at mouth, AZ
Little Colorado River at Cameron, AZ
Little Colorado River at mouth, AZ
Bright Angel Creek, AZ
Havasu Creek, AZ

5. Suspended-sediment data are collected bimonthly under the auspices of the U.S. Geological Survey Toxics Waste Program at Pinal Creek at Setka Ranch near Globe, AZ.

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

District Chief, WRD
U.S. Geological Survey
375 West Euclid Avenue
Tucson, AZ 85719

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 224
705 North Plaza Street
Carson City, NV 89701

District Chief, WRD
U.S. Geological Survey
4501 Indian School Road, NE
Suite 200, Pinetree Office Park
Albuquerque, NM 87110

District Chief, WRD
U.S. Geological Survey
Room 1016 Administration Building
1745 West 1700 South
Salt Lake City, UT 84104

District Chief, WRD
U.S. Geological Survey
2617 E. Lincolnway, Suite B
Cheyenne, WY 82001

District Chief, WRD
U.S. Geological Survey
Bldg. 53, Denver Federal Center
Mail Stop 415, Box 25046
Lakewood, CO 80225

LOWER COLORADO (15) REGION

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities.

a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Black Creek	Asaayi Lake	Tohdildonih	McKinley, San Juan	NM

b. Resource Conservation & Development

Watershed	County	State
Mohave Wash	Mohave	AZ

This study was a joint effort of USDA, SCS, and Montana Department of Natural Resources and Conservation to evaluate sediment production resulting from the plow-out of large areas of range.

2. Reservoir Sedimentation Surveys

Reservoir sedimentation surveys were made in the following reservoirs:

Reservoir	County	State
Sunnycove	Maricopa	AZ

GREAT BASIN REGION

GEOLOGICAL SURVEY

Bear Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Bear River near Corinne, UT, as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are being collected on a comprehensive level in cooperation with the Utah Department of Natural Resources at:

Bear River at Idaho-Utah State line
Bear River near Collinston, UT

3. Suspended-sediment data are being collected on a quarterly basis at Bear River at Border, WY, as part of the National Stream Quality Accounting Network (NASQAN).

4. Suspended-sediment data are being collected on a hydrograph basis at Bear River above reservoir, near Woodruff, UT, and Smith's Fork near Cokeville, WY, and on a 6-week and storm-event basis at Twin Creek at Sage, WY, in cooperation with the Wyoming Department of Environmental Quality.

Great Salt Lake Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Red Butte Creek at Fort Douglas, near Salt Lake City, UT, as part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a quarterly basis at Weber River near Plain City, UT, and at Jordan River at Salt Lake City, UT, on a bimonthly basis as a part of NASQAN.

Escalante - Sevier Lake Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Sevier River near Lynndyl, UT, as a part of NASQAN.

2. Suspended-sediment data are being collected on a comprehensive level at Sevier River at Hatch, UT, in cooperation with the Utah Department of Natural Resources. (Discontinued September 30, 1992)

Black Rock Desert-Humboldt Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Humboldt River near Carlin, NV, as part of NASQAN.

2. Suspended-sediment data are being collected on an annual basis at Humboldt River at Palisade, NV, and at Humboldt River at Old U.S. 40 Highway Bridge near Dunphy, NV.

Central Lahontan Subregion

1. Suspended-sediment data are being collected at the following sites as part of NASQAN:

Walker River near Wabuska, NV (bimonthly)
Carson River near Fort Churchill, NV (quarterly)
Truckee River near Nixon, NV (quarterly)

2. Suspended-sediment data are collected monthly or more frequently during runoff events at the following sites as part of the Lake Tahoe Stream Monitoring Program (in cooperation with the Tahoe Regional Planning Agency):

Third Creek near Crystal Bay, NV
Incline Creek near Crystal Bay, NV
Incline Creek at Highwy 28 at Incline Village, NV
Incline Creek above Tyrol Village near Incline Village, NV
Glenbrook Creek near Glenbrook, NV
Logan House Creek near Glenbrook, NV
Edgewood Creek at Palisade Drive near Kingsbury, NV
Edgewood Creek at Stateline, NV
Eagle Rock Creek near Stateline, NV
Edgewood Creek below Highway 50 near Stateline, NV
Edgewood Creek tributary above Edgewood Clubhouse near Stateline, NV
Edgewood Creek at Lake Tahoe near Stateline, NV
Trout Creek at Pioneer Trail near South Lake Tahoe, CA
Trout Creek at USFS Road 12N01 near Meyers, CA
Upper Truckee River at Highway 50 above Meyers, CA
Upper Truckee River at South Upper Truckee Road near Meyers, CA
Ward Creek below Page Meadows near Tahoe Pines, CA
Ward Creek below North and South Forks near Tahoe Pines, CA

3. Suspended-sediment data are collected periodically during runoff events at the following sites as part of the Lake Tahoe Stream Monitoring Program (in cooperation with the Tahoe Regional Planning Agency):

First Creek near Crystal Bay, NV
Second Creek at Lakeshore Drive near Incline Village, NV
Wood Creek at Lakeshore Drive near Incline Village, NV
Wood Creek above Jennifer Street near Incline Village, NV
Wood Creek at mouth near Crystal Bay, NV
Incline Creek tributary at Country Club Drive near Incline Village, NV
Third Creek at Village Blvd. at Incline Village, NV
Third Creek below unnamed tributary near Incline Village, NV
Glenbrook Creek at Old Highway 50 near Glenbrook, NV
North Logan House Creek above Highway 50 near Glenbrook, NV
Edge Creek tributary near Dagget Edgewood Creek tributary near Dagget Pass, NV
Edgewood Creek below South Benjamin Drive near Dagget Pass, NV

4. Suspended-sediment daily stations are being operated at the following sites as part of the Tahoe Monitoring Program (in cooperation with the Tahoe Regional Planning Agency, California Water Resources Control Board, and the University of California at Davis):

Trout Creek at South Lake Tahoe, CA
Upper Truckee River at South Lake Tahoe, CA

General Creek near Meeks Bay, CA
Blackwood Creek near Tahoe City, CA
Heavenly Valley Creek near Tahoe Valley, CA
Ward Creek at State Highway 89 near Tahoe Pines, CA

5. Suspended-sediment data are being collected twice-yearly at the following sites in cooperation with the U.S. Army Corps of Engineers:

Martis Creek at Highway 267 near Truckee, CA
Martis Creek Lake near Truckee, CA
Martis Creek near Truckee, CA

6. Suspended-sediment data are being collected on a periodic basis at Sagehen Creek near Truckee, CA, as part of the National Hydrologic Benchwork Network.

Central Nevada Desert Basins Subregion

1. Suspended-sediment data are being collected quarterly at Steptoe Creek near Ely, NV, and South Twin River near Round Mountain, NV, as part of the National Hydrologic Benchmark Network.

Special Studies

1. A long-term, ongoing statewide program of investigations of sediment and debris transport by flash floods continued during 1991.

2. A long-term investigation of sediment and debris hazards related to flooding is in the eighth investigative year at the Nevada Test Site.

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

District Chief, WRD
U.S. Geological Survey
333 W. Nye Lane
Carson City, NV 89706

District Chief, WRD
U.S. Geological Survey
1016 Administration Building
1745 West 1700 South
Salt Lake City, UT 84104

District Chief, WRD
U.S. Geological Survey
Room W-2233, Federal Building
2800 Cottage Way
Sacramento, CA 95825

District Chief, WRD
U.S. Geological Survey
230 Collins Road
Boise, ID 83702

District Chief, WRD
U.S. Geological Survey
2617 E. Lincolnway, Suite B
Cheyenne, WY 82001

GREAT BASIN (16) REGION

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities.

a. Resource Conservation & Development

Watershed	County	State
Clover Creek	Tooele	UT

An interagency resource inventory is planned to asses conditions related to ground water quality, water quantity, and salt incursion in aquifers. Also, hydrologic condition of the ground water recharge area in the watershed will be assessed. The study will also include a comprehensive erosion and sedimentation evaluation.

b. Conservation Operations

Watershed	County	State
Chalk Creek	Summit	UT

Work has been completed in cooperation with numerous federal and state agencies to determine sediment yield from rangeland and streambank areas within the watershed. Present studies are continuing to determine best management practices and alternatives to enhance water quality of Chalk Creek.

PACIFIC NORTHWEST REGION

Bureau of Reclamation

Thief Valley Reservoir - A resurvey of Thief Valley Reservoir on the Powder River in Union County in Oregon was completed in June of 1992 between elevations 3093.8 and 3143. The bathymetric and aerial photogrammetric data will be used to develop a topographic map and revised area and capacity tables to be completed in 1993.

Mann Creek Reservoir - A resurvey of Mann Creek Reservoir on Mann Creek in Washington County in Idaho was completed in June of 1992 between elevations 2782.7 and 2903. The bathymetric and aerial photogrammetric data will be used to develop a topographic map and revised area and capacity tables to be completed in 1993.

Savage Rapids Diversion Dam - A bathymetric survey to estimate the volume of sediment behind the dam was completed in June 1992. Analysis of deposited sediment samples completed in November of 1992 found a number of trace elements. Practically all of the 320 acre-feet of sediment will be eroded and transported out of the reservoir area after removal of the dam.

PACIFIC NORTHWEST REGION

CORPS OF ENGINEERS

North Pacific Division

Portland District

Sedimentation Surveys.

1. Reservoir Surveys.

a. Toutle River, Washington. Monitoring of sediment deposits behind the Mount St. Helens Sediment Retention Structure (SRS) continued in 1992. Sediment range surveys found 6.0 million cubic yards (mcy) of deposition during Water Year (WY) 1992. This brings the total volume of material trapped since November 1987 to 30.9 mcy. Sediment samples indicate that most of the material deposited is in the 0.25mm to 16mm size range, with silts and clays making up less than 5 percent of the deposit. Sediment range surveys and material sampling will continue on an annual basis.

b. Scheduled Resurveys. Sedimentation is not a common problem in Portland District reservoirs. However, Fern Ridge Reservoir was resurveyed for the first time since the ranges were established in 1947. Applegate Lake and Willow Creek Lake will be resurveyed when funding becomes available.

2. Channel Surveys.

a. Cowlitz and Toutle Rivers, Washington. Channel cross-section surveys were repeated along the lower 20 miles of the Cowlitz River. The surveys were used to determine flood protection levels along the Cowlitz River and, combined with U.S. Geological Survey sediment data from the Toutle River at Tower Road, to monitor the impacts of the SRS. This year will be the last year surveys will be taken for analysis.

b. Columbia River, Oregon and Washington. Repeated hydrographic surveys were made along the Columbia River deep-draft navigation channel between Portland/Vancouver and the mouth. These surveys were used to plan maintenance dredging, and to study shoaling and disposal problems. Initial results of the Interim Disposal Area D monitoring program show erosion during the first 4 months following the March 1992 disposal. The site then remained stable for the next 9 months. The monitoring program will continue until about March 1994.

c. Coos Bay, Oregon. Repeated hydrographic surveys were made along the Coos Bay deep-draft navigation channel between the mouth and river mile 15 at the Port of Coos Bay. These surveys were used to plan maintenance dredging and to study shoaling and disposal problems.

Other Investigation. Mount Pinatubo, The Philippines - Field investigation and sedimentation analysis were conducted on eight river basins impacted by the June 1991 eruption of Mount Pinatubo. Final report, due December 1993, will include sediment erosion and deposition forecasts, control measures, economics, and environmental assessment. Sediment data includes, bed material

samples, channel surveys, aerial photographs, and limited suspended sediment samples.

General Sediment Information. The following projects were accomplished in 1992.

1. District-wide sediment quality evaluation.
2. Coordination with resource agencies to assure compliance with water quality.
3. Continue Tongue Point monitoring program.
4. Complete evaluation and plans for ocean dredge material disposal sites (ODMDS).
5. Initiate Columbia River ODMDS studies for future O & M and Columbia River Deepening.

Objectives 1-4 will continue in 1993. Under objective 1, sediment quality assessments were completed for the Columbia River, Lower Williamette River, Government Island Channel, Chinook Channel, Baker Bay Channel to Ilwaco and Rogue River Entrance. With regard to number 3, all field work has been completed and a final joint USACE/NMFS report is in preparation. With regard to number 4, an evaluation report for the Siuslaw River was completed and forwarded to EPA, Region 10 for preparation of final-site designation documents. Finally, also regarding number 4, the Tillamook Bay report was delayed pending results of an EPA funded benthic study. Number 5 has been delayed pending agreement with Columbia River Port authorities concerning the Columbia River Deepening Feasibility Study.

Seattle District

Sedimentation Studies. A recon-level reservoir sedimentation assessment of the effect of a proposed additional storage plan at Howard Hanson Dam was accomplished. The assessment indicates that the proposed plan should not significantly affect storage capacity of the reservoir.

Walla Walla District

Sedimentation Studies.

1. Lower Granite Pool Sedimentation Study. Hydrologic and sediment transport studies are continuing with the objective of determining a permanent, long-term solution to flood control and navigation problems created by progressive sediment accumulation in the upper end of Lower Granite Pool. This is the fifth year in a previously-planned 5-year test and monitoring program in which the environmental effects of in-water disposal of dredged material are being evaluated at mid-depth (20-60 feet) and deep-water (greater than 60 feet) disposal sites. During January and February, 571,000 cubic yards of sediment were dredged from the vicinity of the Clearwater River confluence and used to complete a deep-water disposal site at River Mile (RM) 119. Approximately 2 additional years will be required to monitor the effects of this fill on anadromous fish habitat.

2. Lower Granite Drawdown Test. A 30-40-foot test drawdown on Lower Granite Pool was performed during the month of March as part of a plan to evaluate methods of preserving endangered salmon runs. The effect of the drawdown on sediment movement in the pool was evaluated by measuring sediment transport and turbidity during the drawdown. Volumes of erosion and deposition were determined by comparing surveys taken before and after the drawdown. The depth of delta deposition at the mouth of Almota Creek was measured, and the progress of channel erosion through the delta was monitored photographically and with successive cross section surveys during the drawdown. Sediment depth transects were measured in exposed areas along the south shoreline at RM 120 and RM 131.

Sedimentation Surveys.

1. Lower Granite Pool. Selected sediment ranges were resurveyed immediately before and after the drawdown in the reach between RM 130.44 to 141.21 on the Snake River, RM 0.0 to 1.66 on the Clearwater, and RM 0.07 to 0.14 on Asotin Creek. Additional sediment ranges were surveyed in the fall to complete the remainder of the reservoir.

2. Little Goose Pool. Cross section and profile surveys were performed between RM 97.63 and 104.45 to evaluate the effects of a 15-foot test drawdown of Little Goose Pool on sediment deposits in the vicinity of the Schultz Bar Reach. A large accumulation of sediment in this area has affected navigation in the past.

PACIFIC NORTHWEST REGION

GEOLOGICAL SURVEY

Kootenai-Pend Oreille-Spokane Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at South Fork Coeur d'Alene River at Cataldo, ID, as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment are being collected on a monthly basis at Sand Creek near Sandpoint, ID, in cooperation with Bonner County, ID.

3. Suspended-sediment data are being collected on a quarterly basis at Hayden Creek below North Fork, near Hayden Lake, ID, as part of the National Hydrologic Benchmark Network.

4. Suspended-sediment data are being collected in cooperation with the Idaho Department of Health and Welfare on a quarterly basis at:

Kootenai River at Porthill, ID
Clark Fork near Cabinet, ID
Priest River near Priest River, ID
South Fork Coeur d'Alene River near Pinehurst, ID
Spokane River near Post Falls, ID

Upper Columbia Subregion

1. Suspended-sediment data are being collected in cooperation with the U.S. Environmental Protection Agency on a daily basis at:

Clark Fork at Deer Lodge, MT
Clark Fork at Turah Bridge near Bonner, MT
Blackfoot River near Bonner, MT
Clark Fork above Missoula, MT

and on a periodic basis at:

Clark Fork near Galen, MT
Little Blackfoot River near Garrison, MT
Flint Creek near Drummond, MT
Rock Creek near Clinton, MT

2. Suspended-sediment data are being collected on a bimonthly basis in cooperation with the Bureau of Indian Affairs at the following stations:

Little Bitterroot River near Perma, MT
Crow Creek at mouth near Ronan, MT
Mission Creek at National Bison Range at Moiese, MT
Jocko River at Dixon, MT
Flathead River at Perma, MT
Revais Creek below West Fork near Dixon, MT

3. Suspended-sediment data are being collected at the following sites as part of NASQAN:

Clark Fork below Missoula, MT (bimonthly)
Flathead River at Columbia Falls, MT (quarterly)
Flathead River at Flathead, British Columbia (quarterly)

4. Suspended-sediment data are being collected on a periodic basis at Columbia River at Northport, WA, at Columbia River at Vernita Bridge near Priest Rapids Dam, WA, and at Okanogan River at Malott, WA, as a part of NASQAN.

5. Suspended-sediment data are being collected on a periodic basis at Andrews Creek near Mazama, WA, as a part of the National Hydrologic Benchmark Network.

6. Suspended-sediment data are being collected on a quarterly basis at Columbia River at Richland, WA, in cooperation with the U.S. Department of Energy.

Yakima Subregion

1. Suspended-sediment data are being collected periodically at Yakima River near Union Gap, WA, and at Yakima River at Kiona, WA, as part of NASQAN.

2. Suspended-sediment data were collected on a periodic basis at Buckskin Creek near Gleed, WA, Moxee Drain near Union Gap, WA, Granger Drain at Granger, WA, Sulfur Creek Wasteway near Sunnyside, WA, and Chandler Canal near Prosser, WA, as part of NAWQA.

Upper Snake Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Cache Creek near Jackson, WY, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment and bedload data are collected weekly during spring runoff at Pacific Creek at Moran, WY, in cooperation with Grand Teton National Park.

3. Suspended-sediment data are being collected on a bimonthly basis at Snake River near Heise, ID, as a part of NASQAN.

4. Suspended-sediment data are being collected on a bimonthly basis and bedload data during spring runoff at Snake River above Jackson Lake at Flagg Ranch, WY, in cooperation with Grand Teton National Park.

5. Suspended-sediment data are being collected on a quarterly and storm-event basis at Salt River above reservoir, near Etna, WY, in cooperation with the Wyoming Department of Environmental Quality.

6. Suspended-sediment data are being collected in cooperation with the Idaho Department of Health and Welfare on a quarterly basis at:

Snake River at Lorenzo, ID
Blackfoot River near Blackfoot, ID
Henry's Fork near Rexburg, ID
Snake River near Blackfoot, ID
Portneuf River near Tyhee, ID
Beaver Creek at Spencer, ID
Big Lost River near Arco, ID

Middle Snake Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Snake River at King Hill, ID, and Boise River near Parma, ID, as a part of NASQAN.

2. Suspended-sediment data are being collected on a quarterly basis at Big Jacks Creek near Bruneau, ID, as a part of the National Hydrologic Benchmark Network.

3. Suspended-sediment data are being collected in cooperation with the Idaho Department of Health and Welfare on a quarterly basis at:

Boise River at Glenwood Bridge near Boise, ID
Snake River near Minidoka, ID
Salmon Falls Creek near Bellevue, ID
Boise River near Middleton, ID
NF Payette River at Cascade, ID
SF Payette River at Lowman, ID
NF Payette River at McCall, ID

Lower Snake Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Salmon River near White Bird, ID, and Clearwater River at Spalding, ID, as part of NASQAN.

2. Suspended-sediment data are being collected in cooperation with the Idaho Department of Health and Welfare on a quarterly basis at Little Salmon River at Riggins, ID, Salmon River at Salmon, ID, Pahsimeroi River at Ellis, ID, Lemhi River near Lemhi, ID, and Johnson Creek at Yellow Pine, ID.

3. Suspended-sediment data are being collected periodically at Snake River at Burbank, WA, as a part of NASQAN.

4. Suspended-sediment data are being collected on a periodic basis from Minam River at Minam, OR, as a part of the National Hydrologic Benchmark Network.

Middle Columbia Subregion

1. Suspended-sediment samples are being collected on a periodic basis at John Day River near McDonald Ferry, OR, as a part of NASQAN.

2. Suspended-sediment samples are being collected in cooperation with the Confederated Tribes of the Warm Springs Reservations on a periodic basis at:

Shitike Creek at Peters Pasture
Shitike Creek near Warm Springs
Warm Springs River near Simnasho
Mill Creek near Badger Bute
Beaver Creek below Quartz Creek
Warm Springs River near Kahneeta

Lower Columbia Subregion

1. Suspended-sediment data are being collected on a periodic basis at Columbia River at Warrendale, OR, and Columbia River at Beaver Army Terminal near Quincy, OR, as a part of NASQAN.

Willamette Subregion

1. Suspended-sediment data are being collected on a periodic basis from Tualatin River at West Linn, OR, and at Willamette River at Portland, OR, as a part of NASQAN.

2. Suspended-sediment samples will be taken at the following Willamette River basin locations during five high-flow events and during winter and summer base-flow periods, each year, from October 1, 1991, through September 30, 1993. These data will be used to define spatial and temporal sediment concentrations, loads and yields in the main stem and tributaries.

Willamette River at Portland, OR
Clackamas River near Clackamas, OR
Tualatin River at West Linn, OR
Willamette River at Salem, OR
Santiam River at Jefferson, OR
Willamette River at Harrisburg, OR
Long Tom River at Monroe, OR
McKenzie River at Colberg, OR
Coast Fork Willamette River near Goshen, OR

3. Samples will be taken from these same Willamette River basin locations for particle-size analyses during one high-flow and winter base-flow each year, during the same period.

4. Sediment loads will be calculated using suspended-sediment and discharge relations for the period October 1, 1991, through September 30, 1993.

5. Bedload will be approximated for the Willamette River locations using an appropriate bedload equation.

6. Bed-sediment samples were collected and analyzed for selected trace organics and trace elements at 14 Willamette River locations on the main stem and tributaries during the summer of 1992. Also, during this period, bed-sediment samples were collected at 6 additional Willamette River main stem and tributary locations, and analyzed for organic compounds (PCDD and PCDF) only. All samples were sieved, and the finer than 62-micron-diameter sediment was submitted for analysis.

Sites sampled for trace organics, trace elements, PCDD, and PCDF are:

Johnson Creek at Gresham, OR
Beaver Creek near Troutdale, OR
Beaverton Creek at Beaverton, OR
Clackamas River at Oregon City, OR
Willamette River at Newberg, OR
Yamhill River at Dayton, OR
Rickreall Creek at Rickreall, OR
Santiam River near Jefferson, OR
Middle Fourth Lake near Albany, OR
Calapooia River at mouth near Albany, OR
Willamette River near Corvallis, OR
McKenzie River near Coburg, OR
A-3 Channel at Wallis and 5th Street at Eugene, OR
Willamette River at Linton, OR

Sites sampled for organic compounds (PCDD and PCDF) only, are:

Willamette River at Portland, OR
Tualatin River at West Linn, OR
Fanno Creek at Durham, OR
Johnson Creek at Milwaukie, OR
Mack River near Blue River, OR
Amazon Creek near Eugene, OR

Oregon-Washington Coastal Subregion

1. Suspended-sediment data are being collected on a periodic basis at Rogue River near Agness, OR, Siuslaw River near Mapleton, OR, Nehalam River near Foss, OR, Chehalis River at Porter, WA, and at Queets River near Clearwater, WA, as a part of NASQAN, and at South Umpqua River at Roseberg, OR, in cooperation with Douglas County and as a part of NASQAN.

Puget Sound Subregion

1. Suspended-sediment data are being collected on a periodic basis at Skagit River near Mount Vernon, WA, and at Puyallup River at Puyallup, WA, as a part of NASQAN.

Special Studies

1. Suspended-sediment, bed-material, and bedload data are being collected on a periodic basis at the following stations:

Green River above Beaver Creek near Kid Valley, WA
South Fork Toutle River at Camp 12 near Toutle, WA
North Fork Toutle River at Kid Valley, WA
Toutle River at Tower Road near Silver Lake, WA
Muddy River below Clear Creek near Cougar, WA

Automatic pumping sediment samplers are also operated at most sites. The goal is to compute daily sediment discharges and to continue evaluation of the sediment systems of streams affected by the 1980 eruption of Mount St. Helens. Instrumentation research is an ongoing part of the sediment-transport studies in the Toutle River. In situ suspended-sediment analyzers are installed at both the North Fork Toutle River near Kid Valley and Toutle River at Tower Road sites. Data from these instruments are being compared to traditional laboratory analysis of suspended-sediment samples. Depth sounding of the mobile streambed continued at the North Fork Toutle River at Kid Valley. Observations of dune migration in fine gravel were summarized in a technical paper. Measurements of dune celerity throughout a storm-runoff event were made with the use of dual depth sounders.

2. Channel geometry data are being collected at 30 sites to support research on erosional processes and evolution of the drainage system.

Sediment-transport and hydraulic data are being collected at stations in the Toutle River basin to describe vertical and horizontal profiles of suspended sediment and velocity. Bedload samples are being collected with enlarged Helley-Smith samplers at several sites. These samples are being compared with samples from several other bedload samplers, including two Helley-Smith configurations, two Chinese bedload samplers, and the VUV sampler. Results of these comparisons should result in suggested bedload samplers for a variety of stream environments. Several bedload equations are being tested for use on

steep streams. Two reports on these comparisons are in preparation. Methods are continuing to be developed for understanding variations in sediment discharge in time and space. To improve the control of measuring and sampling equipment, stayline are used at the cableways at North Fork Toutle River above Bear Creek, North Fork Toutle River at Kid Valley, Toutle River at Tower Road gaging stations, and Muddy River below Clear Creek near Cougar, WA.

Hydrologic hazard research in volcanic terrain centered around understanding the mechanics, frequency, and magnitude of debris flows originating on the volcanos. Debris flows transport vast amounts of sediment and are only now starting to be recognized and understood.

The sedimentation activities covered in the hydrologic hazards of the Mount Hood project fall into two main categories:

(1) Mapping of deposits emplaced through both volcanic (lahars, pyroclastic flows) and nonvolcanic (jokulhlaups, avalanches) means. Deposits are being mapped to provide volume and inundation information and are being stratigraphically located to provide frequency of event information.

(2) Investigation of areas of hydrothermal alteration high on the edifice. Areas of intense alteration are considered to be weak areas of the mountain and subject to collapse and subsequent initiation of clay-rich mass movements. Areas of alteration are being located, mapped, and sampled.

Debris-flow monitoring and landslide initiation research are planned for field studies in China under cooperative arrangements between research colleagues at the WRD project office at the Cascades Volcano Observatory in Vancouver, WA, and colleagues in China. Laboratory research on debris-flow rheology was started at the project office by testing rotational shear vane viscometers. Several reports on mass-movement and debris-flow rheology are in various stages of completion.

A study to define the sediment sources and processes causing turbidity in the Bull Run watershed was planned in 1987 and started in April 1988. Recent forest management activities have caused concern of possible water supply degradation. Turbidity is a parameter of key importance. Following thorough analysis of existing data, an enhanced monitoring effort using battery-operated continuous turbidimeters will begin. Magnetic minerals from soil profiles, stream channels, and reservoir deposits will be analyzed to determine possible turbidity sources.

3. The Cascades Volcano Observatory, Vancouver, WA, conducts a training activity on sediment-sampling field techniques each year in October. The training is conducted on behalf of the Water Resources Division, but a few slots are reserved for cooperator and other Federal agency personnel to attend. The total attendance at each training session is limited to 24 students.

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

District Chief, WRD
U.S. Geological Survey
230 Collins Road
Boise, ID 83702

District Chief, WRD
U.S. Geological Survey
Federal Building, Room 428
301 So. Park Avenue
Helena, MT 59626-0076

District Chief, WRD
U.S. Geological Survey
10615 S.E. Cherry Blossom Drive
Portland, OR 97216

District Chief, WRD
U.S. Geological Survey
1201 Pacific Avenue, Suite 600
Tacoma, WA 98402

District Chief, WRD
U.S. Geological Survey
2617 E. Lincolnway, Suite B
Cheyenne, WY 82001

District Chief, WRD
U.S. Geological Survey
1201 Pacific Avenue, Suite 600
Tacoma, WA 98402

PACIFIC NORTHWEST (17) REGION

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities.

a. Public Law-566

Major Drainage	Watershed	Stream	County	State
Columbia River	Omak Creek		Okanogan	WA

b. River Basin Investigations

Major Drainage	Watershed	Stream	County	State
Puget Sound	Discovery Bay		Jefferson	WA

c. Idaho State Agricultural Water Quality Program (SAWQP)

Major Drainage	Watershed	Stream	County	State
Snake River	Clearwater River	Lolo & Jim Ford Creeks	Clearwater, Idaho	ID
Snake River	Middle Snake River	Scott's Pond	Jerome	ID
Snake River	Camas Creek	Corral, Willow, Soldier, and Elk Creeks	Camas	ID

d. Conservation Operations

Major Drainage	Watershed	Stream	County	State
Columbia River	Arkansas River		Cowlitz	WA
Columbia River	Silver Lake		Cowlitz	WA
Columbia River	Skamokawa Creek		Wahkiakum	WA

These studies were a joint effort of the Soil Conservation Service and the Conservation District to determine the impact of sediment on water quality within the basins.

CORPS OF ENGINEERS

South Pacific Division

Los Angeles District

Sediment Sampling Stations. The following sediment sampling stations are operated by the USGS and supported by the District: Santa Ana River at E St., San Bernardino County, CA (Gage No. 11059300), (Santa Ana River Project); Santa Ana River at Santa Ana, Orange County, CA (Gage No. 11078000), (Santa Ana River Project); Little Colorado River near Joseph City, AZ (Gage No. 09397000), (Little Colorado River at Holbrook, AZ. Project). Sampling methods are described in the USGS Water Resources Data publications. The sediment records will be furnished to the District if required and/or published at a later time by the USGS in the Water Resources Data reports.

Office Activities.

1. A qualitative sedimentation analysis has been completed in support of the Las Vegas Wash and Tributaries Preconstruction, Engineering and Design (PED) phase of the study. This analysis was conducted to determine the volume and location of sediment deposition in the Red Rock detention basin and its affect on the proposed outlet works.

2. A detailed sedimentation study was continued for Mission Creek in Santa Barbara, California, as part of the Lower Mission Creek General Design Memorandum. The work completed to date includes sampling and gradation analysis of bed-material as well as a detailed sediment routing analysis to determine the inflowing gravel concentration to the project. A flume study was completed at the Waterways Experiment Station to study the effect of bed-material movement on hydraulic roughness in supercritical flow. Preliminary results indicate that hydraulic roughness increases with increasing concentration of bed-load material. At high concentrations of bed-load material, bed forms may develop, and the flow regime may change from supercritical to subcritical or critical. Additional numerical analyses have been conducted to determine the performance of the channel outlet with respect to flushing the sand plug at the beach.

3. A detailed sedimentation study was completed for the Santa Paula Creek General Reevaluation Report. The purpose of the study is to estimate the effects of sediment deposition on the capacity of the existing channel of Santa Paula Creek at Santa Paula, California. The study utilized a special version of the HEC-6 sediment transport computer program to perform sediment routing computations with bed material sizes ranging up to large boulders. Various combinations of antecedent and succedent flows were analyzed to assess the impact of insufficient time to dredge the channel between storms. The HEC-6 model failed to reproduce observed trends of deposition in the channel. As a result, the study was completed with a simplified analysis by utilizing the SAM sediment transport computer program together with manual computations. This study was the subject of a meeting of the Committee on Channel Stabilization.

4. A detailed sedimentation study was initiated for the Carneros Creek Detailed Project Report. The purpose of the study was to analyze the preliminary hydraulic design for flood control improvements on Carneros Creek at Goleta, Santa Barbara County, California. The proposed project includes a debris basin, bifurcation structure, flood control channels, and a detention basin. The work completed to date includes a preliminary estimate of the design sediment inflow to the debris basin based on the transport capacity of the natural channel upstream. The SAM computer program was used to prepare the estimate. Future work will include estimating the wash load into the debris basin, and routing the total sediment loads through the downstream detention basin and channels. Recommendations will be made for modifications to the hydraulic design of the project to alleviate any adverse sedimentation conditions discovered from the sedimentation analysis. This study is scheduled for completion in 1993.

5. A detailed sedimentation study was initiated for the Tanque Verde Creek Detailed Project Report. The purpose of the study was to analyze the preliminary hydraulic design of a single levee to be located along Tanque Verde Creek in Tucson, Arizona. The work completed to date includes a detailed sediment routing analysis using the HEC-6 computer program to determine trends of aggradation and degradation along the project reach. Additional analysis of local scour was performed manually. The results of the analysis will be used to assist in setting the alignment of the levee, top of the levee, and the toe of the levee revetment. This study is scheduled for completion in 1993.

6. A planning-level study was completed for the Norco Bluffs Reconnaissance Report. The objective of the study was to estimate the future, without-project erosion rate of the Norco Bluffs along the Santa Ana Riverside County, California. Since analytical procedures are not available for estimating future streambank or bluff erosion as a function of flood frequency, an attempt was made to empirically correlate locations and amounts of bluff retreat with flood frequency based upon analysis of available historical data. Several complicating factors hindered the analysis, most notably difficulty in interpreting the available aerial photography, variations in the time span between the flood events and the photography, and human intervention. As a result, it was not possible to establish a correlation bluff retreat and flood frequency, and the average annual rate of future bluff retreat was assumed to be the same as the historical rate. The average annual rate of bluff retreat was computed as the total net retreat for each of several zones in the study reach divided by an appropriate period of time. The computed amounts of erosion were then adjusted for factors that would either increase or decrease the erosion rate. These factors involved unerodable areas of the bluff, the stability of the existing bluff face, and the limiting width of the meander zone of the river.

7. A detailed sedimentation analysis was completed for Nogales Wash, located in Arizona, in support of the Nogales Wash and Tributaries Basis for Design Report. This analysis identified and quantified impacts of sediment on the project performance and impacts of the project on the stream system morphology. Results of this analysis indicate that the project should function adequately in regards to sediment transport, deposition, and degradation. The project will not induce a negative impact on the stream morphology upstream or downstream of the project.

Sacramento District

Sediment Studies.

1. Arroyo Pasajero, California - Reconnaissance. The proposed project is located along the western margin of the Central San Joaquin Valley. Arroyo Pasajero originates in the coastal mountain ranges and ponds both water and sediment discharges against the California Aqueduct. A sediment engineering investigation (SEI) was finalized in FY 1992 to circumstantiate sediment yield from the upper watershed for use in studies to evaluate potential measures to upgrade existing measures protecting the aqueduct from these water and sediment discharges.

2. Coyote and Berryessa Creeks, California - General Design Memorandum. The proposed flood control project is located in the cities of San Jose and Milpitas, California immediately south of the San Francisco Bay in the Santa Clara Valley. The recommended project includes overflow channels and offset levees on Coyote Creek and concrete-lined channels and offset levee and berm system on Berryessa Creek. SEI of both creeks were initiated in FY 1990. The SEI of Coyote Creek was completed in FY 1991. The SEI of Berryessa Creek was completed in FY 1992. The SEI's were conducted to evaluate potential impacts of sediment on project performance and potential project impacts on the sediment transport characteristics of each stream course. On Berryessa Creek, the SEI indicated the need for two sediment basins to ensure the flood control capability of the project channels would not be compromised by inflowing sediments.

3. Guadalupe River, California - General Design Memorandum. The project consists of channel improvements to the Guadalupe River as it flows through the City of San Jose. The upstream reach of the project will have a concrete-lined bypass channel. A sediment study of project effects reflecting recent design modifications was initiated during FY 1991 and will be completed in FY 1993.

4. Truckee River, Nevada - General Design Memorandum. The proposed project is located in the Reno-Sparks metropolitan area and extends along an approximate six mile reach of the Truckee River as well as up several tributaries. The flood control project will include levees, flood walls and some channel excavation. An SEI was initiated in FY 1989 to address potential impacts of sediment on project performance. Elements of SEI include a geomorphic analysis of the study area which was completed in FY 1990 and numerical simulation of sediment transport through the study reach using computer program HEC-6 which was completed in FY 1992. Bed material sediments range up to small boulder in size.

6. Yuba River, California - Feasibility Study. The proposed project is located along the Yuba River, part of the Sacramento River Flood Control Project. The study area was heavily impacted by hydraulic mining in the late 1800's. An SEI was initiated in FY 1991 and continued in FY 1992 to evaluate the potential geomorphic and sediment engineering impacts of increasing the level of protection afforded by existing levees in the study area.

San Francisco District

Sediment Studies. Maintenance dredging of Federal harbors and channels. Bathymetric surveys of the Alcatraz Disposal Site continued on a near monthly basis during the year. Results from these surveys were used in determining disposal management restrictions such as allowable monthly disposal rate and dump locations within the disposal site boundaries. The survey data were used to determine dispersion rates for both hopper and clamshell dredged material.

A major sediment study was initiated in 1992 by the Waterways Experiment Station (WES) for the District in support of the "Long Term Management Strategy" for San Francisco Bay. The immediate objectives of the work are to: a) determine and predict the disposal and probable fate of dredged material from existing and potential disposal sites; b) provide additional information on the sediment budget for the Bay system, including net sediment fluxes and tidal exchanges; and c) provide guidance on the use of model results to manage disposal sites. The long term objective of the work is to provide a framework toward a future verified three-dimensional numerical model of hydrodynamics and sediment transport in San Francisco Bay. Field data collection for the study was completed in June 1992 with a final draft report scheduled to be completed in October 1993.

Sediment engineering studies were initiated in 1992 for flood control feasibility studies on the Upper Guadalupe River in the City of San Jose and the Petaluma River in the City of Petaluma. The purposes of the studies are to determine sediment yield, assess upstream and downstream effects of the projects, evaluate potential scour and deposition in the study reaches, and to evaluate bed and bank stability problems that may arise from the proposed projects. The Petaluma River sediment study was completed in 1992 and has shown that the proposed channel widening and floodwall project would have minimal adverse sediment impacts.

CALIFORNIA REGION

GEOLOGICAL SURVEY

North Coastal Subregion

1. Suspended-sediment and bedload data are being collected in Redwood National Park to evaluate the sediment transport rates caused by both natural processes and logging activities within the park. Data collection began in 1973 in cooperation with the National Park Service. The Park Service is using this data to develop management practices that will reduce erosion rates. The current sampling network includes the following stations:

Redwood Creek near Blue Lake (daily)
Redwood Creek at Orick (daily)

2. Suspended-sediment data are being collected on a daily basis and bedload data on a periodic basis at Grass Valley Creek at Fawn Lodge near Lewiston and at Trinity River below Limekiln Gulch near Douglas City, in cooperation with the U.S. Bureau of Reclamation (USBR).

3. Suspended-sediment data are being collected on a quarterly basis at Elder Creek near Branscomb, as part of the National Hydrologic Benchmark Network, and at Smith River near Crescent City, as part of National Stream Quality Accounting Network (NASQAN).

4. Suspended-sediment data are being collected on a bimonthly basis at Klamath River near Klamath, Russian River near Guerneville, and at Eel River at Scotia, as part of NASQAN.

5. Suspended-sediment and bedload data are being collected on a periodic basis at Little Grass Valley Creek near Lewiston in cooperation with the USBR.

6. Suspended-sediment and bedload data are being collected on a periodic basis, in cooperation with Mendocino County Water Agency, at Russian River near Hopland and Ukiah.

Sacramento Basin Subregion

1. Suspended-sediment data are being collected on a daily basis at Feather River near Gridley and at Sacramento River at Freeport, in cooperation with the California Department of Water Resources.

2. Suspended-sediment data are being collected on a bimonthly basis at Sacramento River at Keswick, as part of NASQAN.

North Lahontan Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at Susan River at Susanville, as part of NASQAN.

San Francisco Bay Subregion

1. Suspended-sediment and bedload data are being collected in the Cull Creek and San Lorenzo Creek Basins to document sediment transported into Cull Creek and Don Castro Reservoirs, respectively, and to test erosion control procedures. Data collection began in the 1979 water year, in cooperation with Alameda County Flood Control and Water Conservation District, and includes the following stations:

San Lorenzo Creek at San Lorenzo (daily)
San Lorenzo Creek above Don Castro Reservoir near Castro Valley (daily)
Cull Creek above Cull Creek Reservoir near Castro Valley (daily)
Cull Creek Tributary No. 4 above CC Reservoir (storm event)

2. Suspended-sediment data are being collected on a bimonthly basis at Napa River near Napa, as part of NASQAN.

San Joaquin Basin Subregion

1. Suspended-sediment data are being collected on a daily basis at San Joaquin River at Vernalis, in cooperation with the California Department of Water Resources.

2. Suspended-sediment data are being collected on a quarterly basis at Mokelumne River at Woodbridge, as part of NASQAN, and at Merced River at Happy Isles Bridge near Yosemite, as part of the National Hydrologic Benchmark Network.

Central Coastal Subregion

1. Suspended-sediment and bedload data are being collected on a periodic basis at San Antonio River near Lockwood, and at Nacimiento River near Bryson, in cooperation with Monterey County Water Resources Agency.

2. Suspended-sediment data are being collected on a bimonthly basis at Salinas River near Chular and on a quarterly basis at Pajaro River at Chittenden, as part of NASQAN.

3. Suspended-sediment and bedload data are being collected on a periodic basis, in cooperation with the California Department of Boating and Waterways, at the following stations:

Soquel Creek at Soquel
San Lorenzo River at Big Trees
Pescadero Creek near Pescadero
San Gregorio Creek at San Gregorio

4. Suspended-sediment and bedload data are being collected on a periodic basis at Carmel River near Carmel, in cooperation with the Monterey Peninsula Water Management District.

Tulare Basin and South Lahontan Subregions

1. Suspended-sediment data are being collected on a bimonthly basis at Kings River below NF near Trimmer and Kern River at Kernville, as part of NASQAN.

South Coastal Subregion

1. Suspended-sediment data are being collected on a periodic basis at Santa Ana River near San Bernardino and Santa Ana River at Santa Ana in cooperation with the COE.

2. Suspended-sediment and bedload data are being collected on a periodic basis, in cooperation with the California Department of Boating and Waterways at the following stations:

San Juan Creek at San Juan Capistrano
Arroyo Trabuco at San Juan Capistrano
San Luis Rey River at Oceanside

3. Suspended-sediment data are being collected on a bimonthly and storm-event basis at Santa Ana River below Prado Dam as part of NASQAN, and in cooperation with the Corps of Engineers.

4. Suspended-sediment data are being collected on a periodic basis at Ventura River near Ventura and Santa Clara River at Montalvo in cooperation with California Department of Boating and Waterways and Ventura County Public Works Agency.

5. Suspended-sediment data are being collected on a quarterly basis at Los Angeles River at Long Beach and on a bimonthly basis at San Luis Rey River at Oceanside as part of NASQAN.

Colorado Desert Subregion

1. Suspended-sediment data are being collected on a quarterly basis at Alamo River near Calipatria as part of NASQAN.

Special Studies

A study of factors controlling sediment resuspension in South San Francisco Bay was started during 1992. Suspended-sediment data are being collected on a biweekly basis at four sites to calibrate optical backscatter sensors. This study is part of a cooperative program with the San Francisco Regional Water Quality Control Board to assess the residence times of sediment-bound trace metals in South San Francisco Bay.

A study to determine the recent history of trace-metal pollution in bed sediments of South San Francisco Bay was begun in the fall of 1992. Core samples (1 meter deep) were collected offshore of San Leandro and San Lorenzo Creeks. Material was removed from selected sections for trace-metal analysis, particle-size distribution, and dating using radioisotope analysis. This study is part of a cooperative program with the Alameda County Flood and Water Conservation District to evaluate the distribution of non-point source pollutants in South San Francisco Bay.

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

District Chief, WRD
U.S. Geological Survey
Room W-2233, Federal Building
2800 Cottage Way
Sacramento, CA 95825

CALIFORNIA (18) REGION

SOIL CONSERVATION SERVICE

1. Studies of gross erosion, sediment yields, or sediment damages were made for the following activities.

   a. Public Law 566

Major Drainage	Watershed	Stream	County	State
Feather River (Sacramento River Basin)	Indian Creek	Indian Creek	Plumas	CA

This investigation was conducted as part of the Indian Creek Watershed Work Plan Study and Environmental Impact Report (in preparation), and follows earlier investigations (Indian Valley River Basin and Preauthorization Report, 10/91; East Branch North Fork Feather River Erosion Inventory Report, 2/89). The objective of the study was to find means to reduce erosion and sediment damage in the Indian Creek Watershed, and to restore local aquatic and riparian resources. Historic rates of streambank erosion and land loss along Indian Creek in Indian and Genesee Valleys were evaluated. Average annual rates of streambank erosion, land loss, and sediment yield fro future without- and future with-project conditions were estimated. Proposed alternatives include grazing management and geomorphic stream restoration.

2. Special Studies

Major Drainage	Watershed	Stream	County	State
Sacramento River	Middle Creek	Middle Creek	Shasta	CA
Ascondido Creek	San Elijo Lagoon	Escondido Creek	San Diego	CA

Middle Creek Watershed: A sedimentation study was performed to locate and quantify sources of sediment from disintegrated granite (DG) soils. The primary goal of the study was to reduce the total volume of sand-sized sediment entering Middle Creek and damaging anadromous fish habitat in the creek and in the Sacramento River. Various land treatment practices for controlling erosion in this urbanizing watershed were evaluated for cost-effectiveness in reducing sediment yield. The most cost-effective practices were grouped in various combinations, and the total costs and sediment yield reductions for each alternative were estimated.

San Elijo Lagoon Natural Resource Study: An erosion and sediment study was done (report in preparation). Other agencies and groups involved in the study include the County of San Diego, City of Escondido, City of Solano Beach, City of Encinitas, San Diego Association of Governments, Sand Diego Regional Water Quality Control Board, San Elijo Lagoon Conservancy, California Department of Fish and Game, San Diego County Department of Environmental Health, and San Diego County Department of Parks. The primary goals of the study were to estimate average annual rates of sediment yield to San Elijo Lagoon, determine which erosion processes or land uses impact the Lagoon the most, and identify practices that would reduce sediment yield to the lagoon. Erosion and sediment yield rates were estimated for present, future-without project, and future-with project conditions. Sediment yields were estimated for San Elijo Lagoon, Lake Wholford, Lake Dixon, San Dequito Reservoir, a debris basin above the city of Escondido, and to the city of Escondido.

ALASKA REGION

GEOLOGICAL SURVEY

Yukon Subregion

1. Suspended-sediment data are being collected on a periodic basis at the Yukon River at Pilot Station, AK, as a part of the National Stream Quality Accounting Network (NASQAN).

2. Suspended-sediment data are being collected on a periodic basis at the Tanana River at Nenana, AK, as part of NASQAN.

3. Suspended-sediment data are being collected on a periodic basis at Lignite Creek above mouth near Healy, AK, as part of a cooperative study with the Alaska Division of Geological and Geophysical Surveys.

Southwest Subregion

1. Suspended-sediment data are being collected on a periodic basis at the Kuskokwim River at Crooked Creek, AK, as part of NASQAN.

South-Central Region

1. Suspended-sediment data are being collected on a periodic basis at the Talkeetna River near Talkeetna, AK, as part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected on a periodic basis at the Copper River at Million Dollar Bridge near Cordova, AK, as a part of NASQAN.

3. A 1991-1993 cooperative study with the Alaska Department of Transportation and Public Facilities on the geomorphology of the lower Copper River includes periodic suspended sediment collection at eight bridges and periodic bedload sampling at four bridges.

Southeast Subregion

1. Suspended-sediment data are being collected on a periodic basis at the Stikine River near Wrangell, AK, as part of NASQAN.

2. Suspended-sediment data are being collected on a periodic basis at the Alsek River near Yakutat, AK, as part of a program with the National Park Service.

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

District Chief, WRD
U.S. Geological Survey
4230 University Drive, Suite 201
Anchorage, AK 99508-4664

HAWAII REGION

GEOLOGICAL SURVEY

Hawaii Subregion

1. Suspended-sediment data are being collected bimonthly at Honolii Stream near Papaikou, Hawaii, as a part of the National Hydrologic Benchmark Network.

2. Suspended-sediment data are being collected bimonthly at Wailuku River at Hilo, Hawaii, as a part of National Stream Quality Accounting Network (NASQAN).

3. In cooperation with the Hawaii Department of Land and Natural Resources, daily suspended-sediment data are being collected at Waimanu Stream near Kamuela.

Maui Subregion

1. Suspended-sediment data are being collected bimonthly at Kahakuloa Stream near Honokohau, Maui, as a part of NASQAN.

Molokai Subregion

1. Suspended-sediment data are being collected bimonthly at Halawa Stream near Halawa, Molokai, as a part of NASQAN.

Oahu Subregion

1. Suspended-sediment data are being collected at the following sites:

   Waikele Stream, Waipahu, Oahu, on a daily basis as part of the Federal CBR program.

   Kalihi Stream, at Kalihi, Oahu, quarterly as a part of NASQAN.

   Kamooalii Stream below Luluku Stream near Kaneohe, Oahu, on a daily basis in cooperation with the U.S. Army Corps of Engineers.

2. In cooperation with Hawaii State Department of Transportation, daily suspended-sediment data are being collected at the following stations on Oahu:

   North Halawa Stream near Kaneohe
   North Halawa Stream near Honolulu
   Right Branch of Kamooalii Stream near Kaneohe
   Luluku Stream at altitude 220 feet near Kaneohe
   South Fork Kapunahala Stream at Kaneohe
   Haiku Stream near Heeia

Kauai Subregion

1. Suspended-sediment data are being collected on a bimonthly 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
677 Ala Moana Boulevard
Suite 415
Honolulu, HI 96813-5412

CORPS OF ENGINEERS

South Atlantic Division

Jacksonville District

Suspended Sediment Sampling at Puerto Rico in cooperation with U.S. Geological Survey.

1. Continuous collection of sample were achieved on Rio Grande de Loiza at Caguas for the purpose of reservoir sediment study.

2. Daily collection of sample were achieved on Rio Piedras (at Winston Churchill Bridge, PR-1 Bridge and Pinero Ave Bridge) and on Quebrada Josifina at Pinero Ave Bridge for the purpose of debris basin design for concrete channels project. Daily sample were also obtained on Rio Fajardo at Fajardo for gathering background data for environmental evaluation.

3. Continuous collection of tributary sediment load data for reservoir were obtained on Rio Caguitas at Caguas.

4. One new sediment sampling program was initiated in May 1992 for debris basin design purpose.

CARIBBEAN REGION

GEOLOGICAL SURVEY

Puerto Rico Subregion

1. Suspended-sediment data are being collected on a bimonthly basis at the following sites as a part of the National Stream Quality Accounting Network (NASQAN):

Rio de la Plata at Toa Alta, Puerto Rico
Rio Grande de Manati near Manati, Puerto Rico
Rio Grande de Anasco near San Sebastian, Puerto Rico
Rio Grande de Patillas near Patillas, Puerto Rico

2. Suspended-sediment data are being collected on a weekly basis and during high flows at Rio Tanama near Utuado, Puerto Rico, in cooperation with PREQB. The samples from low and high flow were collected by the observer. Automatic samplers were used for samples at middle and high stages at different intervals of time. The data collected are used for developing sediment transport curves and computing daily sediment records.

3. Suspended-sediment data are being collected on a daily basis and during high flows at the following stations, in cooperation with the U.S. Army Corps of Engineers (COE):

Rio Piedras at Rio Piedras, Puerto Rico
Rio Piedras at El Senorial, Puerto Rico
Rio Rosario near Hormigueros, Puerto Rico
Rio Caguitas near Caguas, Puerto Rico

The data was collected by observers and technicians at low and high stages. Automatic samplers were used for collecting data at middle and high flow. The data collected are used for developing sediment transport curves and computing daily sediment records.

Special Studies

1. Suspended-sediment data are being collected on a weekly basis and during high flows at the following sites, in cooperation with PRASA and PRDNR to determine total sediment input from Rio Grande de Loiza Basin to Lago Loiza reservoir:

Rio Grande de Loiza at Caguas, Puerto Rico
Rio Gurabo at Gurabo, Puerto Rico
Rio Canas at Canas, Puerto Rico

The data was collected by observers and technicians at low and high stages. Automatic samplers were used for collecting data at middle and high flow. The data collected was used for developing sediment transport curves and computing daily sediment records.

2. Suspended-sediment data are being collected on a weekly basis, biweekly, and during high flows at the following sites, in cooperation with PRASA to determine the amount of suspended-sediment entering and leaving several reservoirs which are used for water supplies:

Lago La Plata, Puerto Rico
Rio de La Plata at Comerio, Puerto Rico
Rio Guadiana at Guadiana, Puerto Rico
Rio de La Plata below La Plata, Dam Puerto Rico

Lago Toa Vaca, Puerto Rico
Rio Toa Vaca above Lago Toa Vaca, Puerto Rico

Lago Loiza, Puerto Rico
Rio Grande de Loiza below Damsite, Puerto Rico

The data was collected by observer and technicians at low and high stages. Automatic samplers were used for collecting data at middle and high flow. The data collected was used for developing sediment transport curves and computing daily sediment records.

3. Suspended-sediment data are being collected on a weekly basis and during high flows at the following sites, in cooperation with PRASA, to determine the load suspended-sediment at different sties with different land uses:

Quebrada Blanca at Jagual, Puerto Rico
Quebrada Salvatierra near San Lorenzo, Puerto Rico
Rio Grande de Loiza at Highway 183 near San Lorenzo, Puerto Rico
Rio Gurabo below El Mango, Puerto Rico
Rio Valenciano near Juncos, Puerto Rico
Rio Caguitas near Aguas Buenas, Puerto Rico
Rio Caguitas at Villa Blanca at Caguas, Puerto Rico
Rio Turabo above Borinquen, Puerto Rico
Rio Bairoa at Caguas, Puerto Rico

The data was collected by observer and technicians at low and high stages. Automatic samplers were used for collecting data at middle and high flow. The data collected was used for developing sediment transport curves and computing daily sediment records.

4. Suspended-sediment data are collected weekly and during storms at three sites in the Luquillo Experimental Forest (LEF) and at two sites in the Rio Grande de Loiza watershed. Automatic samplers are used for storm sampling at each site. These five sites are located on matched pairs of small (3- to 25-square kilometer drainage area) rivers. One of the rivers in the LEF, a pristine area, drains intrusive bedrock, the other river in the LEF drains volcaniclastic bedrock. Two rivers in the agriculturally developed Loiza watershed drain the same two lithologic types. All samples from all five sites are analyzed for sediment concentration. Selected storm samples and periodic base-flow samples are analyzed for principal ions, nutrients, and trace metals. This work is supported by the WRD WEBB program.

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

District Chief, WRD
U.S. Geological Survey
G.P.O. Box 364424
San Juan, Puerto Rico 00936

LABORATORY AND OTHER RESEARCH ACTIVITIES

ARIZONA

AGRICULTURAL RESEARCH SERVICE

The Southwest Watershed Research Center, Tucson, Arizona, has extensive research in hydrology, erosion, and sedimentation.

Erosion Prediction Technology - RUSLE

1. The revised Universal Soil Loss Equation (RUSLE) is described and compared to the USLE for a typical application on a corn-soybean rotation near Indianapolis, IN. Individual factor values are described and the changes detailed supporting the new technology. Of great significance is the development of a computer program which permits rapid soil loss estimation for a wide variety of cropping and management practices. With this new technology, it is possible to estimate soil loss for conditions not possible with the older USLE technology.

2. Water quality modeling generally requires estimates of the amount of eroded material entering water courses. This information is necessary because sediment often transports adsorbed chemicals. Numerous models have been developed to assist with assessment of this problem. These models often contain some modification of the Universal Soil Loss Equation (USLE). A recently initiated effort to improve USLE technology has produced a computer-based model, RUSLE (Revised USLE), which employs new relationships to estimate values of the six soil loss factors in the equation. Three input data bases are required, containing climatic data, crop data, and field operations data. Although numerous specific entries for these data are contained in the program, in many cases users must supplement or modify the supplied data. Results of a sensitivity analysis help users tailoring the data bases to specific conditions.

3. An approach to estimate the Revised Universal Soil Loss Equation (RUSLE) erosivity factor (R) for locations without long-term rainfall intensity records is described and its application in areas outside the continental United States (U.S.) summarized. Correlations based on average monthly precipitation data and measured R-factor values for 155 U.S. stations are used to develop relations for estimating R values in the United States. The 155 stations were segregated based on the annual distribution of monthly precipitation and the correlations improved. Exclusion of 23 stations with both "winter-type" precipitation distributions and modified Fournier index values greater than 100 mm improved the relations for the remaining 132 stations ($r2 = 0.81$). Estimation equations developed for locations outside the continental U.S. were found to estimate R values for U.S. stations that correlated well ($r2 = 0.81$) with measured values. If relations developed in other parts of the world estimate R values that are correlated with measured values in most U.S. locations, then relations developed from these U.S. stations for estimating R and 10-year frequency storm EI values can be used in other parts of the world. Using this logic, surrogate relations for estimating R and 10-year frequency storm EI values for locations throughout the world are presented. The estimation relations for R-factor values and 10-year frequency storm EI values will facilitate the use of RUSLE for locations with only monthly precipitation data.

4. Rainfall simulation experiments conducted on large plots at various rangeland sites in southeastern Arizona were used to determine temporal variability in rangeland soil erosion. Soil erodibility varied monthly, seasonally, and yearly and appeared to depend on vegetation and soil type. Short term (monthly or seasonally) variability was greater than year to year variability unless treatment effects were interacting. The RUSLE "K" factor cycles differently than measured erodibility; factor estimates were the highest when measured erodibilities were the lowest. Time related changes in erosion rates associated with rangeland treatment need to be evaluated over a multi-year period using multi-plot studies.

Erosion Prediction Technology - WEPP

5. Erosion prediction is the most widely used and most effective tool for soil conservation in the United States. Over the last several decades the Universal Soil Loss Equation (USLE) has been used to predict soil erosion. While the USLE has been used successfully, it does have limitations. The United States Department of Agriculture initiated the processed-based Water Erosion Prediction Project (WEPP) to develop a new generation of water erosion prediction technology. WEPP is a continuous simulation model with a daily time step. For every day, plant, litter, and soil characteristics important to soil erosion are updated. Model development and validation results are described for the plant growth and decomposition submodel used for application of the WEPP hillslope profile model on rangelands. Initial validation results from eight plant communities indicate that basic governing equations and approaches used in WEPP are effective for simulating plant growth on rangelands. To improve model performance in arid and semiarid areas new algorithms that incorporate wind and herbivorous insects will need to be incorporated for transferring standing dead biomass to litter.

6. The Water Erosion Prediction Project (WEPP) watershed model was evaluated through a sensitivity analysis to identify the uncertainties of model predictions when it is intended to simulate soil erosion in rangeland watersheds. Model uncertainties arise due to errors in parameter estimation and errors in model conceptualization. The identification of model sensitivities to hydrologic and erosion parameters provides guidance to the WEPP users for the collection of input data. The analysis ranked the model parameters according to model sensitivity allowing the model user to set up strategies for data collection based on the importance of model parameters for accurate erosion prediction. The results show that hydrologic and erosion predictions are very sensitive to attributes that define a storm event (amount, duration, and time to peak and intensity) and to the saturated hydraulic conductivity parameter. Sensitivity to critical shear stress in soil erosion predictions indicates that interrill flow is the dominant factor of sediment transport under consolidated, untilled soils.

7. Identification of parameter sensitivities provides guidance in collection of field data for parameterization of the Water Erosion Prediction Project (WEPP) model. Parameters evaluated were canopy cover, ground cover, and plant density. Model predicted runoff and soil erosion were quantified for 8 field sites located within the USDA-ARS Walnut Gulch Experimental Watershed in southeastern Arizona. WEPP is very sensitive to precipitation characteristics and surface cover. model is sensitive to plant spacing over a range of plant densities. When plant spacing is closer than 0.5 m rill initiation is inhibited. When spacing between plants exceeds 5 m the influence on rill initiation is insignificant.

Field Experiments & Data Acquisition

8. Upland erosion research using rainfall simulation techniques has been conducted on a wide range of ecosystems in the Western United States. The initial research began in 1981 and was to parameterize rangeland conditions for use in the Universal Soil Loss Equation (USLE) and later the Water Erosion Prediction Project (WEPP) erosion model. The field experimental design has progressed from simple replicated plots needed to parameterize the empirically based USLE to multi-intensity rainfall rates and overland flow injections needed for the dynamic, processed based WEPP erosion model. Results from over ten years of research have shown that erosion pavement (surface rock fragments) can play a major role in reducing soil erosion and that there are temporal changes in rangeland soil erodibility. The Revised Universal Soil Loss Equation (RUSLE) has been developed and includes results of these rangeland erosion studies. The WEPP erosion model is nearing completion and results of two years of intensive rangeland experiments are incorporated into the rangeland, infiltration, and soil modules of the model.

9. Rock fragment covers veneer hillslopes in many parts of the world and influence the operation of hydrologic and geomorphic processes on those surfaces. Spatial variability of percent rock fragment cover on the morphologic components of hillslopes was investigated in southeastern Arizona. In addition, simple statistical models were developed and validated for the estimation of percent rock fragment cover based upon hillslope gradient and a soil-slope factor interaction variable. Although reasonably accurate estimates can be made using either hillslope gradient or the soil-slope factor, it appears more efficient to utilize hillslope gradient alone. Likewise, reasonably accurate estimates can be made using either a composite model for the entire hillslope or unit specific models; however, it appears more efficient to utilize the composite model.

10. Sediment-yield estimates of semiarid regions are often based on measurements made on experimental drainage basins. Sediment sampler efficiency affects these sediment-yield estimates. Two small drainage basins in the Walnut Gulch Experimental Watershed in southeastern Arizona were selected to determine if watershed sediment-yield estimates changed with varying sampling equipment. These watersheds range in size from 3.68 to 4.53 ha and have similar soils, vegetation, and topography. There have been three different

methods used to measured sediment-yields including: (1) depth integrated pump sampler (2) depth integrated pump sampler with accumulated bed material volume, and (3) traversing slot total-load sampler. Measured sediment-yield estimates from each watershed were compared on the basis of method used to derive the estimates. Sediment-yield (t/ha) versus storm runoff (mm) plots were developed to determine changes in sediment-yields for the periods of each sampling method on each watershed. Plots of time versus sediment-yield rate (t/ha/mm) were used to determine if sediment-yields changed over time regardless of sampling method used. Comparisons indicated that watershed sediment-yields increased as sampling methods improved from the pump to the traversing slot sampler.

General

11. Semiarid lands such as the USDA-ARS Walnut Gulch Experimental Watershed located in southeastern Arizona are characterized by extreme variability of precipitation, soils, vegetation, infiltration, runoff, and erosion. Research results are presented which describe and summarize this temporal and spatial variability and the impact of management decisions in altering the hydrologic and sedimentation cycles. Potential impacts of global change on the natural resources of such semiarid lands are also reported. Specific results include frequency relationships for runoff amounts. Analytical simulation models such as CREAMS, RUSLE, WEPP, and KINEROS, developed using Walnut Gulch data, are described and used to illustrate the impact of management on the hydrologic cycle in a semiarid environment. Finally, data and research findings from the Walnut Gulch watershed are being used to develop new technology for natural resource modeling and management. Specific examples for erosion control and water quality impacts are presented.

12. A keynote address entitled "Development and Application of Modern Soil Erosion Prediction Technology - The USDA Experience" was given at the Australian Society of Soil Science 4th National Soils Conference - Soil Protection and Productivity, Adelaide, Australia, April, 1992. Erosion prediction efforts were described to provide a synopsis of USDA's experience in developing and applying soil erosion prediction technology in its research and development activities and in its soil conservation programs. Erosion prediction technology discussed included the USLE, CREAMS, RUSLE, and WEPP. The discussion of future considerations included: 1) implications of computer-based prediction technology, 2) the role of national data bases, 3) implications of predicting sediment yield, 4) the use of erosion predictions in multiobjective decision making, and 5) the need to replace the soil loss tolerance concept with multiobjective criteria that include onsite erosion and offsite sediment yield.

For additional information contact Leonard J. Lane, Research Leader, Southwest Watershed Research Center, USDA-ARS, 2000 E. Allen Road, Tucson, AZ 85719.

COLORADO

AGRICULTURAL RESEARCH SERVICE

An adaptation of ARS Sediment Intrusion and Dissolved-Oxygen transport model (SIDO) was conducted for the USDA Forest Service, Intermountain Research Station (INT) at Boise, Idaho. INT is conducting research to quantify the effects of eroded sediments generated by land use, storm events and wildfire on fishery resources of the South Fork of the Salmon River (SFSR). One important phase of this study requires accurate evaluation of the direct link between sediment deposition in salmon and steelhead spawning areas and fish survival and emergence. ARS has developed the only available model that provides a means to help make this link. Major goals of this study were to extend the SIDO model to conditions prevalent in the SFSR, and coupling it with the U.S. Army Corps of Engineers' HEC-6 sediment routing model and the U. S. Fish and Wildlife Service Instream Water Temperature model (IWTM) to fit conditions in the Poverty Run spawning area. Because fundamentally different mechanisms of sediment intrusion are possible in the SFSR, the project involved investigating these mechanisms and revising the intrusion component of SIDO. INT was also assisted in the design of the field data collection program in the Poverty area. This data was used to verify and validate the models. Field evaluations of the integrated models show that HEC-6 accurately reproduced water stage profiles measured in the Poverty area. Bed degradation simulations compared closely to a laboratory flume experiment, and bed armoring algorithms in HEC-6 did satisfactorily simulate bed armoring observed in the San Luis Valley Canal, Colorado. The sensitivity of the IWTM to selected meteorological variables showed the relative importance of air temperature data in model predictions of instream water temperature. Comparisons of SIDO computations with field data from the Poverty area showed that the mean sediment intrusion mass can be accurately represented and that the model provides a reasonable estimate of the spatial variability displayed by the field data. The tests indicate that the integrated models are suitable for determining the impact of sediment intrusion on the SFSR spawning grounds. All the associated software was implemented on the computer system at the INT, and training sessions were held at Boise to ensure proper technology transfer. Reports and papers documenting this work have completed and the project terminated.

For additional information contact Carlos V. Alonso, Research Hydraulic Engineer, USDA, National Sedimentation Laboratory, P.O. Box 1157, Oxford, MS 38655, formerly at the USDA-ARS, Great Plains Systems Research Unit, Fort Collins, Colorado

GEORGIA

AGRICULTURAL RESEARCH SERVICE

The Southeast Watershed Research Laboratory in Tifton, Georgia has research related to:

1. Sediment and associated nutrient transport from a 4 acre field watershed in the fall line hills region of Georgia are being measured to determine effect of change from conventional tillage to no-till crop production. Double cropping is practiced on the watershed with a summer crop of grain sorghum and a winter crop of wheat. Conventional tillage began in the summer of 1989 and continued until no-till crop production was initiated in the summer of 1992. During the time that conventional tillage was in effect, sediment yield from daily runoff events ranged up to 15 kg/ha. No till crop production will be in effect for 3 years and during that time, sediment measurements will be made for comparison with the conventional tillage measurements.

2. Sediment transport from upland agricultural practices into a managed riparian forest buffer system and a restored riparian forest wetland is being measured at two sites on the Coastal Plain Experiment Station near Tifton, GA. At one site, surface runoff is collected in a 3 m wide trough, measured and sampled at a flume, and then re-distributed through another trough. At the other site, samples are collected through 30 cm wide "dustpan" collectors fitted with flow splitters. Mature riparian forest at this site has been clear-cut and water quality measurements are being made to examine the impact of harvesting. Preliminary data from runoff events at the riparian forest site following clear-cut shows that sediment concentrations are reduced by the residue remaining on the soil surface and by the remaining vegetation.

For additional information contact Adrian W. Thomas, Laboratory Director, Southeast Watershed Research Laboratory, USDA-ARS, P.O. Box 946, Tifton, Georgia 31793

IDAHO

AGRICULTURAL RESEARCH SERVICE

The Northwest Watershed Research Center in Boise, Idaho is conducting sedimentation research related to:

1. Basic processes related to erosion from rangelands in the western United States.

Efforts are aimed at enhancing and validating the Water Erosion Prediction Project (WEPP) model for use on rangelands. This is a cooperative project with the Soil Conservation Service to describe the influence that climate, vegetation and soil have on the spatial and temporal variability of erosion processes. This work is proceeding under the ARS/SCS cooperative effort called "Interagency Rangeland Water Erosion Team" (IRWET).

2. Impacts of mechanical seedbed preparation techniques on rangeland erosion. Efforts are focused on describing the degree of impact and the recovery time needed for different treatments to return to pretreatment conditions. Derived information will be used to enhance our capability for predicting the impacts different rangeland seeding techniques have on erosion.

3. The collection of suspended sediment, stream flow, and meteorological variables from eleven nested watersheds ranging in size from a few acres to 90 square miles within the Reynolds Creek Experimental Watershed in southwest Idaho. Additional runoff and erosion data is also collected from permanent plots of varying size. This information is currently being used to validate the WEPP and SHE models.

For additional information contact Frederick B. Pierson, Research Hydrologist, Northwest Watershed Research Center, 800 Park Blvd., Plaza IV, Suite 105, Boise, ID 83712.

INDIANA

AGRICULTURAL RESEARCH SERVICE

Soil erosion prediction and control research activities at the National Soil Erosion Research Laboratory in West Lafayette, Indiana include the following:

Water Erosion Prediction Prediction Project (WEPP)

WEPP Hillslope Profile Model

1. Progress continues on development of the Water Erosion Prediction Project (WEPP) Hillslope Profile Erosion Model. A new release of the WEPP Hillslope Model is expected sometime in spring 1993, with a larger validation effort to be conducted on this release. Release of a final version to be implemented in SCS field offices is scheduled for 1995.

Recording

1a. Recoding of the WEPP Hillslope Profile model has proceeded under the guidance of a 5-agency recording team, using a FORTRAN coding convention developed by the group. The primary goal of the effort is to enhance model maintainability through making the code more understandable. This has involved major changes in the structure of many modules. Recording has reduced model runtime and eliminated many errors. It is anticipated that enhancements to the main module will permit significant reduction in memory requirements once the lower level modules are recoded. Presently, approximately 60% of the WEPP modules are recorded. With the exception of the winter and irrigation routines, all the scientific modules of WEPP are recorded. Scientific modules recorded in 1992 include sediment routing, hydrologic routing, plant growth initialization, cropland annual and perennial plant growth, rangeland plant growth, percolation, drainage, evapotranspiration, soil water updating, initialization and update of soil parameters, residue, and decomposition. Non-scientific modules yet to be recorded are the initialization and I/O routines.

1b. Infiltration characteristics of no-till versus conventional tillage farming systems were studied during the summer of 1992. The results of the study are being incorporated into the WEPP model to improve infiltration prediction for conservation tillage practices. A new equation to predict saturated hydraulic conductivity was derived based on WEPP field studies conducted on 32 different soils during the summers of 1987 and 1989. Currently this equation and other saturated hydraulic conductivity equations obtained from literature are being tested using runoff plot data. The effect of macroporosity and soil surface crust on infiltration prediction by WEPP has been modified. The modified WEPP infiltration routine is being tested using runoff plot data.

ARS-Indiana

Rainfall Interception by Crop Residue

1c. Conservation tillage practices such as no-till allow significant amounts of residue to remain on the soil surface during growing season. Rainfall is intercepted by crop residue on the soil before it reaches the soil surface. The effect of different residue types (i.e., corn, soybean, wheat) and amounts on soil water balance were studied during the summer of 1992. The amount of rainfall intercepted by plant residue was found to be significant and depended on the type and the amount of residues. The findings are being incorporated into the WEPP water balance routine. The WEPP model with and without a residue interception module was tested on a corn-soybean rotation field located near Champaign, Illinois

Water Balance

1d. Soil water content at rainfall onset affects infiltration rates, runoff and erosion. Accurately predicting evapotranspiration is crucial to modeling the soil water balance. Evapotranspiration equations in WEPP have been modified to improve soil water content prediction. Depending on data availability, WEPP uses the Penman or Penman-Monteith equations. The latter equation not only reconciles thermodynamic and acrodynamic aspects, but also includes aerodynamic resistance to sensible heat and vapor transfer by vegetation.

Application to Rangeland and Disturbed Forest Sites.

1e. Soil samples from various range communities and disturbed forest sites are being analyzed in the laboratory to determine detachment rate, crust strength, aggregate stability, and hydraulic conductivity. The findings will be incorporated into the WEPP model to improve infiltration and erosion prediction for range and disturbed forest sites.

Soil Data Base

1f. Significant progress was made in the development and verification of the WEPP soil data base during 1992. The final soil data base should provide soil and erosion parameters needed by various USDA-ARS models. The soil data base is being developed in cooperation with SCS scientists in Lincoln, Nebraska.

Global Climate Change

1g. The effect of possible global climate change (rainfall and temperature) on the hydrology of three fields located near Morris, Minnesota, Champaign, Illinois, and Temple, Texas was studied by performing 100 year WEPP simulations for each site.

ARS-Indiana

WEPP Watershed Model

2. The WEPP Watershed Model was transferred from USDA-ARS in Tucson, Arizona to USDA-ARS in West Lafayette, Indiana in 1992. Extensive code verification is continuing on the prototype version, and new components will be inserted in spring 1993 (including the new Hillslope model code and an impoundment component). A release of the WEPP Watershed Model is expected sometime in summer 1993 with validation to begin in late 1993.

WEPP Grid Version Model

3. The WEPP Grid Version is under development at USDA-ARS in Morris, Minnesota, however, progress was slow in 1992 due to loss of computer programming staff. A working prototype of the Grid model is expected in late 1993.

FIELD AND LABORATORY EXPERIMENTAL STUDIES

1. Field and laboratory experiments were conducted to study the effect of soil amendments for erosion control. In the laboratory inorganic gypsiferous by-products from coal-fired power plants were added to soil surfaces to determine their potential use for erosion control. Depending of the process used for desulfurization, the materials varied in their effectiveness. Material from an atmospheric fluidized bed boiler (FBC) was found to be the most effective at reducing runoff and interrill soil loss on a wide range of soils with varying properties. The addition of the FBC prevented the soil surface from sealing by slowly releasing electrolyte to the electrolyte devoid rainwater which kept the clays from dispersing and maintained a greater steady state infiltration rate. The flocculation of the soil also produced lesser sediment concentrations in the runoff that did occur. Addition of FBC on one soil was found to have a negative effect on infiltration and soil loss. This was a sandy soil with highly dispersive clay. FBC caused the clay to flocculate and physically plug the pores between sand grains. The untreated soil dispersed and the clay was free to be carried away in the runoff and infiltrating water. Rill erosion was found to not be affected by adding this materials. However, with addition of 10 ppm polyacrylamide to the rill and addition of 5 MT/ha of the FBC rill erosion was almost completely eliminated on flow shears up to 6 Pa. Addition of either material in the same amounts alone did not give such dramatic results. This procedure could be used to effectively stabilize rills and small channels such as in furrow irrigation and provide greater erosion control and water use efficiency.

2. A comprehensive field project related to no-till farming and its effects on soil erosion and water quality was conducted in the summer of 1992. Studies included quantification of root growth and water balance, infiltration, earthworm population, runoff, macroporosity, soil erosion and the fate of surface applied starch-encapsulated herbicides. Scientists from

the USDA-ARS National Soil Tilth Laboratory, USDA-ARS National Soil Erosion Research Laboratory, University of Illinois and Purdue University were involved. The majority of studies were conducted on the long-term no-till fields at the Agricultural Development Center (ADC) near Lexington, Illinois. Thirteen additional sites in Indiana and Illinois were studied for earthworm population and infiltration. Earthworm populations were greater than or equal in no-till than in conventional tilled fields on 12 of the 14 sites. Infiltration was much higher in no-till fields with significant earthworm activity. Results from ADC fields showed a pronounced no-till effect in changes of soil fabric and biota which in return resulted in increased infiltration (> 80 mm/hr) and decreased erosion (< 0.2 T/A/h at 125 mm/h rainfall). In addition, the reduced soil evaporation from residue cover under no-till resulted in additional soil moisture in the root zone during commer months when the crop water demand was high. Results of this study are being incorporated into the Revised Universal Soil Loss Equation (RUSLE) and the Water Erosion Predicted Project (WEPP) prediction models.

3. During the summer of 1992, a field experiment was conducted near Lexington, Illinois to determine the effect of long-term tillage systems on rill erodability parameters. The study was on two paired sites on silt loam soils, one which had been in a continuous no-till corn soybean rotation for over 15 years, and the other which had been in a conventional moldboard plow corn-soybean rotation for over 15 years. Surface soil texture characteristics for the two sites were almost identical. The major treatments were freshly tilled soil, soil tilled and allowed to consolidate for approximately 30 days, fully consolidated soil with no residue (no-till site only), and fully consolidated soil with residue (no-till site only). Results of the study showed that the average rill erodability for the freshly tilled soil on the conventional site was significantly higher than that for the freshly tilled soil on the no-till site. Critical hydraulic shear stress was not significantly different between the two sites. Also for both the no-till and conventional site, the average rill erodability for the aged-till plots was higher than that for the freshly tilled, possibly due to low rainfall during the consolidation period and/or drying effects.

4. Soil crusting under natural rain or overhead irrigation is a major cause of poor seedling emergence, low water intiltration and distribution, and increased runoff and erosion in many arable soils. Soil Scientists at the USDA-ARS National Soil Erosion Research Laboratory in West Lafayette, Indiana and USDA-ARS polymer chemists in Peoria, Illinois are cooperating on an interdisciplinary project to develop inexpensive, water soluble starch based copolymers that will be effective for erosion control. By improving soil structure and aggregate stability at the soil surface crust formation might be reduced or prevented altogether. Preliminary field tests have identified a group of molecular structures that are effective soil surface conditioners. Several studies are underway dealing with the dynamics of plant residue decomposition in both the field and the laboratory. Plant residue decomposition is important in predicting the amount of residue cover on the soil surface at any given time. Field observations indicate that differences between varieties of the same species can be as great as

differences between species of plants. Contrary to published literature, neither C-to-N nor lignin-to-N ratios were good predictors of residue mass loss or CO2 evolution (respiration rates). Other relationships are currently being explored. Also, studies regarding tillage burial of residues by chisel plows with various points and sweeps are being conducted in central and southeastern Indiana. The computer-based Residue Management decision support program (RESMAN), estimates the quantity of residue on the surface of a field any time of the year. Originally released in 1991, a special version for the northeastern U.S. was released in 1992 and a Canadian version is being released in 1993.

TECHNOLOGY TRANSFER

1. Final revisions of the Revised Universal Soil Loss Equation (RUSLE) software package are being completed and integrated into the field office system of the Soil Conservation Service (SCS). Testing and evaluation of RUSLE has continued and documentation is being reviewed and revised. Workshops concerning technology transfer of RUSLE have been held with the Soil and Water Conservation Society (SWCS).

2. A plant database was constructed using information collected from SCS Special Project Studies, review of crop literature, and crop surveys sent to agronomists and horticultural specialists. Crop specific information includes parameters describing plant growth, rooting, and residue decomposition characteristics. The database was developed using dBase III Plus and linked to a knowledge-based system. The knowledge-based system provides necessary vegetable crop parameters for use in WEPP and RUSLE, and was developed using Microsoftr Visual Basic for Windows. Target system users are state or regional agronomists preparing cropping and management input values for local SCS offices to use in erosion prediction models. Users are presented with menus for selection of model dependent crop, climatic zone, and erosion prediction parameters. "Best" values are presented for a particular user's case (i.e., cropping scenario) either by displaying parameters contained within the database or determining parameters using "expert rules" when specific crop information is unavailable. Development of the knowledge-based system expands potential use of models such as WEPP and RUSLE into previously unavailable cropping situations and provides erosion prediction results more indicative of the actual field cropping system.

3. Work is progressing on using geographic information systems (GIS) to automate inputs and display outputs of continuous simulation models. Spatially distributed models such as the WEPP Grid and Watershed versions will benefit from a modeling-GIS linkage as the time and expense required for the models will be obtained directly from map layers within the GIS. In addition, the spatial display of erosion and hydrologic outputs will assist users in interpreting model output.

For additional information contact John M. Laflen, Laboratory Director, USDA-ARS-MWA, National Soil Erosion Research Laboratory, 1196 SOIL Building, Purdue University, West Lafayette, Indiana 47907-1196.

IOWA

AGRICULTURAL RESEARCH SERVICE

The National Soil Tilth Laboratory in Ames, Iowa has a research program related to several aspects of sediment transport. These activities are related to:

1. Evaluation of the sediment loads which are transported from fields and watersheds as part of a comprehensive program to evaluate the effects of farming practices on surface and ground water quality. These efforts include sediment sampling of runoff from fields and stream sediment sampling to provide a measure of the total sediment load leaving the watershed. Modifications made to the farming practices include surface residue management and ridge tillage systems and are compared to conventional farming practices.

2. Watershed modeling of the surface runoff is being conducted with the Walnut Creek watershed to compare different models, e.g., HSPF and PRMS, to actual runoff and sediment transport. These studies are being conducted in cooperation with the United States Geological Survey and the U.S. Environmental Protection Agency. These results will be used to evaluate potential changes in the farming practices on an agricultural landscape for surface and ground water quality.

For additional information contact Jerry L. Hatfield, Laboratory Director, National Soil Tilth Laboratory, 2150 Pammel Drive, Ames, Iowa 50011-4419

MARYLAND

AGRICULTURAL RESEARCH SERVICE

Research activities at the ARS Hydrology Laboratory, Natural Resource Institute in Beltsville, Maryland include the following:

1. While the Landsat Multispectral Scanner (MSS) can provide valuable data about surface suspended sediments in inland waters; the feasibility of monitoring chlorophyll using MSS data in waters dominated by suspended sediments has been questioned. In this study, concentrations of chlorophyll-a in inland waters with high average annual concentrations of suspended sediment were measured in three lakes and compared with Landsat MSS data for 107 dates between December 1976 and August 1988. Concentrations of chlorophyll-a ranged from 0.3 to 211 mg per cubic meter for 452 measurements. Concentrations of suspended sediment ranged from 1 to 867 mg/l in the same samples. A systematic decrease in the concentration of chlorophyll-a as concentrations of suspended sediment increased was found. Radiance and reflectance calculated from the 4 MSS bands increased as a function of increasing concentrations of suspended sediment. Radiance and reflectance calculated from the 4 MSS bands decreased as the concentration of chlorophyll-a increased, however no significant pattern of decrease related to the concentration of chlorophyll-a and MSS data could be determined. Thus measurement of chlorophyll-a with broad band (100 nm) MSS data in waters dominated by suspended sediments will not be effective since detection of the increased absorption of radiation due to increasing chlorophyll-a is masked by the increased spectral reflectance due to suspended sediments. Broad band MSS and TM data will provide only limited information on chlorophyll in inland waters dominated by suspended sediment. Remote sensing of chlorophyll in suspended sediment dominated systems will require high spectral resolution data at the chlorophyll absorption areas.

2. Laser altimeter measurements of the physical properties of the surface of the landscape provide unique and rapid measurements of gully and channel morphology. Such measurements of macroscale or microscale topography can be used to measure channel and gully degradation and aggradation and to study their relationship to the surrounding landscape. Such measurements should allow better characterization of flow and stability necessary for engineering studies and construction. In addition, an airborne laser altimeter offers the potential to measure these landscape properties over large areas quickly, easily, timely, and with great detail. Such large area measurements can provide valuable data for understanding and managing channel and gully erosion.

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MINNESOTA

AGRICULTURAL RESEARCH SERVICE

Research activities at the USDA-Agricultural Research Service, North Central Soil Conservation Research Laboratory in Morris, Minnesota include the following:

1. SOIL AGGREGATE LONGEVITY AS DETERMINED BY INCORPORATION OF CERAMIC SPHERES

Tracers (ceramic spheres 1 to 3 mm in diameter) were broadcast on the soil before primary chisel or moldboard tillage in the fall. Ten-kg samples were taken immediately after the next four annual primary tillage operations. Samples were taken in 8-cm increments to 16 cm in the chisel treatment and to 24 cm in the moldboard treatment. Samples were air-dried and rotary-sieved into six aggregate-diameter classes. Soil mass and number of incorporated tracers were recorded for each of the four smaller diameter fractions. The number of aggregates and counts of tracers on the surface and in the interior of individual aggregates were recorded for the two largest diameter fractions. The initial tillage operation incorporated less than 5% of the tracers into soil aggregates. Subsequent tillage incorporates more tracers so that after 3 years, 38% were incorporated with chisel tillage and 33% with moldboard tillage. Differences in the incorporation rate of tracers into aggregates between tillage systems is believed to be partially caused by the shallower burial in chisel compared to moldboard tillage. Accelerated incorporation of tracers buried near the surface may have been caused by biological activity, freezing/thaw, wetting/drying, and tillage operations - all of which are more intense near the soil surface. The number of incorporated tracers per gram of soil increased with aggregate size. After three years, aggregates with diameters >40 mm had twice as many tracers per gram of soil as aggregates with diameters of 3 to 5 mm. In samples taken immediately after the initial tillage operation, the majority of tracers were located on the surface of the aggregates, as if pressed into the aggregate by the tillage tool rather the incorporated during aggregate breakdown and reformation.

2. STEMFLOW AND PREFERENTIAL ROOT FLOW UNDER DIFFERENT CROPS

For the second year, in cooperation with the Agricultural Engineering Department of the University of Minnesota, experimental plot areas 5 m wide by 5 m long were established in the spring. Half of these were planted to corn and half to soybeans. Percolation collectors were installed at a depth of 0.5 m beneath selected corn and bean rows as well as beneath some interrow areas. Simulated rainfall was applied to the test areas with a rainulator at a rate of 3.2 cm per hour for one hour at 3 different stages of crop growth beginning August 6, September 1, and October 5. After the application of simulated rainfall, percolate from these collectors was measured to compare the amount and rate of infiltration beneath the row and

interrow areas. An attempt was also made to measure stemflow on the corn by means of collecting collars placed around the base of several individual stalks. All tests in 1992 were run on the corn plots only. The bean plots were severely damaged in midsummer by deer and consequently, never reached maturity. Results from the stemflow measurements on the corn indicated that from 13% to 48% of rainfall was intercepted by the corn plants and concentrated as stemflow. These values were similar to those measured the preceding year. Preferential flow results from the percolation collectors indicated for the second year in a row that percolation beneath the row areas was greater than beneath the interrow areas. Again, photographs and visual inspection indicated much greater root formation beneath the row areas than the interrow areas.

3. FREEZING AND FREEZE-DRYING REDUCES SOIL AGGREGATE SIZE

Bulk samples of Barnes loam and Hamerly clay loam were separated into three aggregate sizes (0.5-1, 3-5, and 5-12 mm) and equilibrated at 5, 15, 25, or 35 % (wt) water content. After equilibration, samples were further subdivided and exposed to 0, 1, 5, or 10 freeze-thaw cycles, followed by either a freeze-dry or no freeze-dry treatment. Half of the samples were then exposed to rain drop impact and wet sieved to determine wet mean weight diameter (wet MWD), the other half were air dried and dry sieved to determine dry MWD.

Preliminary results indicate that resultant aggregate size was largely a function of initial aggregate size. Soil water content had a larger effect on MWD than did the number of freeze-thaw cycles. For large aggregates, both wet and dry MWD generally decreased with increases in soil moisture. For the small aggregates, the effect of water content varied among treatments. Freeze-drying reduced both wet and dry MWD for the 3-5 and 5-12 mm aggregates, but the reduction was greater for the wet MWD. The differences between soils was greater for wet MWD than for dry MWD, with Barnes having larger MWD than Hamerly. The differences between soils were greater with the large aggregates than with the small aggregates. For the large aggregates, dry MWD was generally greater than wet MWD. This was especially true for Hamerly compared to Barnes, and for freeze-dried compared to no freeze-drying. Freeze-drying is especially detrimental to soil aggregates. Reducing initial water content or exposure to freeze-drying would help reduce wind erosion by maintaining soil cloddiness, and reduce water erosion by retaining resistance to breakdown by rain drop impact.

4. MODELLING THE EFFECTS OF WHEEL TRAFFIC ON SOIL EROSION

A model was developed to evaluate the effects of traffic induced soil compaction on soil erosion by relating soil compaction to soil shear strength, hydraulic shear stress and other soil erosion parameters. Tractor and equipment weight, wheel configuration (number and size), and operating conditions such as soil water, bulk density and organic matter content were used to predict the changes in soil bulk density after traffic. Final scil

cone index was predicted from final bulk density, soil water and organic matter content for a given soil type (clay content). Final hydraulic conductivity was also estimated from final bulk density and other soil parameters. Rill and inter-rill erosion parameters, as well as soil shear strength, were calculated from final cone index. Modified runoff volume, thus hydraulic shear stress, was calculated from final hydraulic conductivity. Finally, sediment loss from the soil as affected by wheel traffic was calculated from rill and inter-rill erosion parameters, soil shear strength, hydraulic shear stress and other soil parameters.

The model is intended to be incorporated into the Water Erosion Prediction Program (WEPP) and Agricultural Non-point Source Pollution Model (AGNPS) currently in use by agricultural and other industries. Several sub-models were developed as a result of this research which can be used for other modelling purposes. The model also has potential use by forestry in determining the changes in soil erosion potential due to the compaction caused by logging activities. The erosion characteristics of power and pipe lines right-of ways are severely affected by wheel traffic. This model can by used to estimate the magnitude of this change.

5. SURFACE COMPACTION AS AFFECTED BY TILLAGE AND LANDSCAPE POSITION

Field plots were established on a landscape starting from the summit position across the backslope position (both positions with good surface and internal drainage) and through the toeslope positions with poor surface and internal drainage. Tillage systems used were moldboard plow, chisel plow, ridge till, and no-till. Crop rotations were continuous corn and corn-soybean and compaction variables were wheel traffic on one side of the planted row, both sides, both side three times, and no wheel traffic on either side. Wheel traffic was applied with a 130 hp tractor with a rear axle load of 6.5 tons. Soil measurements were taken to categorize soil strength, pore volumes and pore size distributions. Two years into the project, bulk density has increased with field traffic with a corresponding increase in penetrometer resistance. Pore volumes decreased with the major decrease occurring in macropore volumes. The surface compaction variable has not yet significantly affected crop yield. Yield variations due to landscape position have been observed and are correlated with depth of topsoil and drainage. As the mollic depth decreases (shoulder position on landscape) yields decrease and as surface and internal drainage decreases (toeslope position) yields decreased. Tillage systems also have not influenced yield.

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MISSISSIPPI

AGRICULTURAL RESEARCH SERVICE

The National Sedimentation Laboratory in Oxford, Mississippi has considerable research relating to sedimentation activities.

1. Measurements of the fine and coarse sediment loads are continuing for Goodwin Creek near Batesville, MS. Automatic pump samples are obtained at all stations and manual sampling efforts are being concentrated at Stations 1 and 2 to evaluate the effects on the bed material load of channel rectifications between these stations. The rectifications were installed by the USCOE to correct severe bank instabilities of this reach. Analyses are continuing to characterize the stochastic characteristics of the bed material loads and to separate the effects of channel modifications, land use changes, and variable hydrologic events on the sediment transport processes in Goodwin Creek.

2. Treatment of the mechanics of sediment transportation in the near-bed region is being made using a convective diffusion model that imposes different turbulent diffusivities in the near-bed region in relation to the relative roughness of the flow boundaries. This is based on previous work on velocity distributions in this region but uses a slightly different functional form that permits a closed-form (analytical) descriptions of the distributions of suspended sediment over the flow depth. The resulting models give the same result as the classical suspension models in the body of the flow but approach the concentration of the sediment in transport at the bed. This bed concentration is the bulk density of the bed material in loose packing for fully developed transport. Work is underway to define the bed concentration for low transport rates in relation to flow and sediment variables when only a fractional layer of bed material is in motion.

3. Time-mean velocity profiles, eddy scale profiles, and relative turbulence intensity profiles were measured in a flume under conditions of systematically-varied suspended sediment concentrations. The sediment used in this experiment was very fine, so that concentration profiles could be kept essentially uniform over the flow depth, displaying no gradients. Under these conditions none of the quantities measured showed any variation related to suspended sediment concentration intensity. Time-mean velocity profiles and relative turbulence intensity profiles were comparable with those obtained in clear water control experiments in this research project, and with those obtained in clear water flows by other investigators. Evidently even capacity concentration of fine suspended sediment, as long as the suspension displays no gradient, has no significant effect on mixing or other processes in channel flow. This probably means that, in models for routing sorbed pollutants down channels, uniform distribution of the pollutant in the channel cross section may be assumed.

4. Experiments on the effect of unsteady flow on the transport of sediment by streams are in progress. A laboratory flume has been modified to allow the flow to be controlled by a personal computer. Sediment transport will be measured by using two successive bed traverses taken such that the migration rate and size of the bed forms can be accurately determined. In this way the average transport rate associated with several dunes can be calculated from traverse data taken over a period of minutes rather than over a period of hours as required by other methods. The results of this study will be useful to adapt existing transport relations developed for steady flows for use with unsteady flows in natural streams.

5. The transport of bed load sediment in several experimental studies has been shown to closely follow a normal distribution. This result was different from other studies which found that the distribution of bed load samples followed other distribution functions. The reason for the differences was attributed to whether samples were collected at one location or over the whole cross section of a channel. The nature of the distribution has important implications as to the number of samples that are needed to obtain a reliable predictor of the mean transport rate for a given flow.

6. The erosion model, ANSWERS, is being modified to include simulation of channel erosion. Current erosion models neglect channel erosion, which is a significant source of sediment transported in a watershed. Goodwin Creek Watershed data is being developed for use as input information and for verification and validation of the model. After validation, conservation tillage practices will be imposed on various subwatersheds. The effects of changing conservation tillage practices on erosion in the fields and in the channels will be studied.

7. Ten years of Goodwin Creek rainfall storm events are being simulated with the erosion model, SWRRB. Storm rainfall events will be simulated based on the total rainfall for each event and predict total storm runoff and sediment yield for each subwatershed. Goodwin Creek total storm runoff and sediment data has been developed for each storm rainfall event on each subwatershed. This simulation will analyze the performance of the model to route runoff and sediment through the system and allow comparisons of the effects of various conservation practices on the total watershed system.

8. Grass Hedges on Cotton Erosion Plots: Stiff grass hedges (Miscanthus sinesis) were placed across the lower ends of standard 5 percent sloping erosion plots in conventional and no-till cotton at Holly Springs, MS in 1991. Runoff and soil losses were then compared with conventional and no-till cotton plots without hedges. The developing hedges greatly reduced soil losses under unusually heavy rains in June of 1991. The soil loss reduction appeared to be the result of deposition of soil above the hedges. More fully developed stiff grass hedges then dramatically reduced soil losses during the 1992 water year (October through September) under high rainfall (65 inches). Conventional-till soil losses were reduced from 28.8 to 6.4 t/acre and no-till losses were reduced from 2.6 to 1.4 t/acre. Hedges reduced runoff from 26 to 23 inches for conventional-till cotton and from 18 to 15 inches for no-till cotton. Nearly fully developed hedges by July of 1992 reduced runoff during that month by 25 percent under 5.5 inches of rainfall on conventional till plots and by 22 percent on no-till plots.

ARS-Mississippi

9. Long-term Erosion Soybean Productivity Study: The loss of soil productivity as erosion progressed continue to be measured and documented on 150 feet long plots of about 3% at Holly Springs, MS. In 1983, twelve pairs of plots were cultivated alike before planting of soybeans. Since that time, one plot in each pair was cultivated in a conventional-till manner, while the other received no cultivation. Conventional-till soybean yields slightly exceeded no-till yields during 1984 and 1985, and equaled no-till yields in 1986. From 1987 through 1991, no-till yields averaged 44 percent greater than conventional-till soybeans. Soil losses were measured during rainfall simulation in 1986, 1987, and 1990 on 2 or 3 pairs of these plots after a light cultivation that immediately preceded the rainfall. The soil loss data indicated that soils overlying a fragipan with a history of continuous tillage are more susceptible to further erosion than soils protected through a no-till management system. Soil loss from simulated-rainfall plots with a 7-year no-till history in 1990 was less than 30% that from conventional-till plots. Almost half of the lower soil loss from the no-till history plots was attributed to the higher soil moisture of the no-till at the time of testing. This study is continuing to determine the long-term effects on soil erosion of no-till and conventional-till systems.

10. Grain Sorghum Studies: Annual soil loss from standard erosion plots (13 by 73 feet, 5% slopes) in ridge-till grain sorghum at Holly Spring, MS during 1987-1990 averaged 5.7 t/ha compared to 7.8 t/ha and 3.3 t/ha from conventional-till and reduced-till, respectively. Annual no-till soil loss for sorghum after conventional-till cotton averaged only 2 t/ha, while no-till sorghum after no-till was further reduced to only 0.3 t/ha. Greater losses from the ridge-till than from reduced-till was attributed to the erosiveness of the higher ridges in ridge-till. Annual average soil loss from larger contoured erosion plots (150 by 73 feet, 5% slopes) in ridge-till grain sorghum was 35 percent of that from up-and-down hill standard erosion plots. However, runoff from the contour plots was only 4% less. Erosion control practice factors, based on comparisons of contoured ridges with up-and down hill ridges, were computed for use in soil loss prediction equations. Soil loss ratios for use in soil loss prediction also were computed for all the cropping practices on the standard erosion plots.

11. No-till Cotton in Narrow Rows: Six 0.25-acre plots were planted to no-till cotton in 1991 at Holly Springs, MS, following several years of no-till and ridge-till grain sorghum on the plots. Soil loss and runoff data collection for the no-till cotton study began October 1, 1991. Two of the 0.25-acre no-till cotton plots were planted in 30-inch rows in 1992; the others remained in standard 40-inch rows. After planting, soil losses averaged 2.8 t/acre and runoff averaged 12.6 inches on two contoured, 0.25-acre, 5% sloping, no-till, cotton plots with 40-inch rows (May through September of 1992). Rainfall during this period was 29.8 inches. On two other similar plots with 30-inch rows, soil losses averaged 0.9 t/acre and runoff averaged 8.0 inches. Soil losses and runoff on two other similar plots, except for lower slopes (2.5%), averaged 0.8 t/acre and 8.9 inches, respectively. Continued runoff and soil loss measurements will be needed to determine the effects of the narrow rows, since lower soil losses on narrow-row plots during 1992 may still have been influenced some by the cropping practices used with the previous grain sorghum study.

ARS-Mississippi

12. Watershed Studies: Runoff, soil loss and water quality data collection began in 1992 on two watersheds (4.5 and 3.5 acres) at Holly Springs that have been in grass for many years. These data will be compared to data that will be collected after these watersheds are returned to cropland production. The objective of the study is to evaluate sediment and agrichemical losses from idle upland watersheds being returned to row crop production with implemented conservation measures.

13. Working with ARS scientists in other disciplines, and with engineers from action agencies, developed designs for unstable stream habitat restoration demonstration projects. The first of three demonstration projects, which involved restoration of a 1 km reach of stream, was constructed in January and February 1992. Initial results indicated that mean water depth and mean scour hole depth, corrected for stage variation, increased 44% and 82%, respectively. The mean length of fish and the number of fish species approximately doubled, and the total weight of fish captured by a unit of sampling effort increased by an order of magnitude. This research has helped development of basic concepts for rehabilitation of aquatic and riparian zone habitats in stream corridors damaged by channel incision.

14. The first year of an ecological and water quality evaluation of the 17 watersheds of the Demonstration Erosion Control (DEC) Project in the Yazoo Basin was completed. The purpose of the study was to determine water quality in the main channel and tributaries of the different watersheds and to evaluate ecosystem integrity for possible changes as the DEC project progresses. Fish and invertebrate communities were sampled and biological indices were developed in order to make stream to stream comparisons of ecological health. Relationships between biological data and physical stream characteristics are being employed as tools to determine the effects of erosion control practices on stream ecology.

15. In evaluating stream ecology and stream bank protection projects, it is important to be able to accurately estimate fish population sizes. Methods used to estimate fish population size may be biased if the collection technique used, violates the underlying assumptions of the method. A study was conducted to determine if fish learn to avoid capture with subsequent sampling attempts, thus resulting in biased estimates of standing stock. Research proved that increasing time between samples provided much greater precision in fish population size estimates.

16. Constructed wetland cells for processing point source agricultural pollution can process nutrients, cBOD, and coliforms efficiently. Two years of field work evaluated how point source dairy waste can be trapped and processed by Bulrush monoculture. Phosphorus compounds can be reduced by 50 percent. Ammonia removal has averaged over 90 percent. Both cBOD and COD have been reduced by 65 percent while coliform reductions have averaged 95 percent. The study shows that wetland cells are efficient during winter as well as during Bulrush growing season. Research is continuing to evaluate long term effectiveness.

ARS-Mississippi

17. A landscape-scale study of an intensively cultivated alluvial floodplain watershed revealed that watershed soils were still sources for residual insecticides. Sediments in wetlands and lakes were substantial sinks. Storm runoff continues to contaminate downstream water resources with insecticides and metals carried with soil particles eroded from watershed soils. Because of water and sediment contamination, fish still accumulated residual pesticides though not to levels found during the 1970's. Three currently-used insecticides were found sporadically in fish, water, and sediment but not in watershed soils. Concentrations of currently-used insecticides were generally low. Occurrence of pesticides indicates the importance of watershed management practices on long-term water quality trends.

18. Studies were conducted to evaluate the effects of tillage practices on surface and subsurface pesticide transport in the loessial uplands of northern Mississippi. Total losses in runoff of the preemerge herbicides, metribuzin and metolachlor, from soybeans were 2% or less of the amounts applied. These losses were independent of established practice (no-till vs. conventional-till) even though no-till reduced sediment loss by two orders of magnitude compared to conventional tillage. In addition, runoff losses of the herbicides were much lower than in previous years because of a longer time interval (2 weeks) between herbicide application and first runoff. During this time interval, herbicide amounts available for runoff from the soil surface were most likely reduced by other processes such as biodegradation, photodegradation, volatilization, and leaching. Herbicide concentrations (65 ppb maximum) in shallow ground water (1-5 feet) in the no-till soybeans were also reduced from previous years because of the 2-week lag between application and the first ground water-producing rainfall event. No shallow ground water occurred in the conventional-till soybeans during the growing season. In the first year of another study, runoff losses of atrazine and alachlor (preemerge herbicides), chlorpyrifos and tefluthrin (granular in-furrow insecticides) and cyanazine (postemerge herbicide) from no-till, reduced-till, and conventional-till corn were determined. The herbicides were also frequently detected in shallow ground water (1-5 feet) but the insecticides were not. Pesticide losses in runoff and concentrations in shallow ground water were highly variable and no effects of tillage differences were found, due to the recency of plot establishment.

19. Studies were conducted to evaluate the effects of conservation tillage practices on agrichemical transport through the fragipan of loessial soils in the uplands of northern Mississippi. The approach was to construct/install ground water sampling wells penetrating substantially into and through the fragipan on 1) no-till and conventional-till soybean watersheds to which metribuzin and metolachlor were to be applied for preemerge weed control and 2) no-till, reduced-till, and conventional-till corn plots to which atrazine, alachlor, and cyanazine were to be applied for preemerge and postemerge weed control. Neither metribuzin nor metolachlor were detected in ground water at the 10-foot depth in either of the soybean watersheds. No water was ever found in any of the deeper wells. Within 2

weeks after application to the corn plots, atrazine and alachlor were found in ground water at the 10-foot depth at maximum concentrations of about 6 and 5 ppb, respectively. At about 5 weeks after application, cyanazine was found at the same depth at a maximum concentration of about 5 ppb. At corn harvest, these concentrations had decreased to about 3, 1, and 2 ppb, respectively. No ground water was ever found in the 20-foot wells penetrating through the fragipan. Results thus far show that some relatively water soluble herbicides penetrated rapidly at least 8 feet into the fragipan. No differences due to tillage have been found.

20. Ground water and runoff studies on the Nelson Research Farm established mean concentrations of nutrients for no-till and conventional-till soybeans in both ground water and surface runoff. The mean NO_3-N, NH_4-N, and PO_4-P concentrations in shallow ground water (3.04 m) for the no-till soybean watershed were 7.57, 0.10, and 0.05 ppm compared with 6.70, 0.11, and 0.04 ppm for the conventional-till . Nitrate-N concentrations in ground water for the conventional-till were higher than those observed for the no-till watershed. Soybean residues are the suspected N source. Nitrate-N concentrations for some storms exceeded 10 ppm and are of interest since no N fertilizers were applied after 1987. For all sites and depths, 28% of all NO_3-N concentrations from the no-till watershed exceeded 10 ppm compared with only 10% for the conventional-till. The mean NO_3-N concentration in ground water of a forested riparian zone downslope from the conventional-till watershed, was only 0.34 ppm. The mean soluble NO_3-N, NH_4-N, and PO_4-P concentrations in runoff for the no-till soybean watershed were 0.59, 0.26, and 0.56 ppm compared with 0.45, 0.16, and 0.08 ppm for the conventional-till. Higher nutrient concentrations in runoff from the no-till watershed are due to leaching of accumulated residues, and the lack of suspended sediments to sorb soluble phosphorus. Runoff from both watersheds had higher concentrations of nutrients, particularly soluble phosphorus, following a broadcast application each spring of 0-20-20, that decreased during subsequent storms. As comparable storm runoff was greater for the conventional-till watershed, soluble nutrient losses, with the exception of phosphorus, were similar for both watersheds. Soluble phosphorus losses from the no till watershed were five to six times that of the conventional-till.

21. Mean NO_3-N, NH_4-N, and PO_4-P concentrations in shallow ground water (3.04 m) for WY 1992 at the Holly Springs Experiment Station in the second year no-till, minimum-till, and conventional-till corn were 5.75, 0.10, and 0.03 ppm. No effects of tillage were found due to the recency of plot establishment. Ground water NO_3-N concentrations increased following surface broadcast applied NH_4NO_3, but decreased in subsequent storms to pre-fertilization concentrations. The NO_3-N increases were more noticeable at the 0.46 m depth compared to the 0.91, 1.52, and 3.04 m depths. During the 1992 WY for the no-till, minimum-till, and conventional-till corn, only 3, 11, and 12%, respectively, of all ground water NO_3-N concentrations exceeded 10 ppm. During the 1992 WY, surface runoff from the no-till corn had the highest yearly mean concentrations of soluble PO_4-P and TOC, and the lowest concentrations of NO_3-N and NH_4-N. As with ground water, surface runoff NO_3-N concentrations increased following NH_4NO_3 fertilization, but decreased rapidly in subsequent storms to pre-fertilization concentrations.

ARS-Mississippi

22. Temporal variations in interrill erosion rates and sediment size distributions as affected by crop growth, soil condition, continued storm rainfall, and prior land use were evaluated on farm fields using simulated rainstorms. Erosion from mid-season cotton with 70% canopy was less than 50% that when cotton first emerged, and erosion decreased further to 15% at full canopy and less than 10% immediately after harvest. This reduction was largely due to increasing crop canopy and residues, but results also indicated that soil erodibility decreased through the crop season. Tilled woodland soil was only half as erodible as tilled soil cropped to continuous cotton, and tilled pasture was midway between. Studies on a wide range of soil types showed that erosion of most bare, tilled soils decreased as storm rainfall continued, with the greatest change for the more erodible soils. Sediment size distributions changed little due to crop stage, cover, or continued storm rainfall, but they were affected by land use history.

23. Infiltration rates were evaluated for a wide range of bare, tilled, cropland soils. Final infiltration rates near the end of a series of intense, high-energy rainstorms were dominantly less than 10 mm/h, although high-sand soils and those of excellent structure were somewhat higher. Many high-silt and high-clay soils had final infiltration rates much less than 10 mm/h. Final infiltration rates were poorly correlated with readily-measured soil properties or with erosion losses.

24. Research on the sediment-trapping effectiveness of stiff-grass hedges was started in a specially designed transparent-wall flume. The channel had a slope of 5%, and flows were those that would occur where runoff from a large area has concentrated. For such conditions, well over half of the loamy sand sediment and about one-fourth of the silt loam sediment was trapped by the grasses. The difference in trapping efficiency was primarily due to the size distribution of the sediment. Nearly all of the material coarser than 250 fm (0.25 mm) was trapped, but very little of the material finer than 16 fm was trapped. The percent of coarse silt and fine sand sized sediment between these two sizes that was trapped varied with flow rate and sediment density (primary particles or aggregates). The grass hedge ponded water, and sediment deposition began at the upstream end of the pool, so most of the deposited material accumulated well upslope from the grass. Future studies are planned to evaluate sediment trapping by different types and configurations of grasses for different flow rates, flow conditions, and sediment sizes.

25. Hydrologic studies which consisted of measurements of infiltration and surface seal development of eight loess soils were conducted. Infiltration was continuously monitored and could be described by a linear function of time for the preponded condition and by a power series for the post-ponding period with appropriate boundary conditions at incipient ponding. Surface seal development was measured from infiltration rate determinations and tensiometric measurement at 1-cm depth below the soil surface using fast response tensiometers. The loess soils showed substantial differences in their hydrologic response. The highest infiltration rates were measured on the Bierbeek soil from Belgium, with little difference between soil materials from the different horizons. The high infiltration response was attributed to a combination of favorable soil properties such as organic

matter content (A-hr), appreciable calcite content (C-hr), and low content of swelling clay material. The lowest infiltration was observed on the Saskatchewan soil with appreciable differences between the A- and B-horizon material. The B-horizon material, with a significant content of swelling clay (smectite), had very low infiltration rates shortly after the occurrence of incipient ponding. The presence of an appreciable amount of organic matter in the A-horizon tended to maintain infiltration rates at higher levels in spite of the presence of finite amounts of swelling clays. The Grenada and Lishi loess soils had similar infiltration characteristics, with the Lishi soil impacted by the presence of calcite and the Grenada by small amounts of iron oxides.

26. Sediment yields have been measured for three adjacent watersheds during CY 1990 and 1991. Two were cropped to no-till soybeans and the third was conventional tillage soybeans. The average rainfall for the two year period was 68.2 inches (32% above the long term 30 yr. average). The two no-till watersheds averaged 27.1 inches of runoff and 0.5 ton per acre sediment yield while the two year average runoff from the conventional till watershed was 31.0 inches and the sediment yield was 9.6 t/ac. Average soybean yield from the no-till fields (3 yr. average) was 29.0 bu/ac. and that from the conventional till soybeans was 27.1 bu/ac.

27. Storm runoff has been measured for three years on sixteen 72.6 ft. x 12 ft. erosion plots and four field-sized watersheds in northern Mississippi. Three of the watersheds and all of the runoff plots are located at one site while the remaining watershed is at a similar geomorphic location. All watersheds have soils with relatively shallow pans and were cropped to soybeans with management systems ranging from conventional tillage to no-till to broad-based terraces. The erosion plots consist of two replications of eight management practices including: conventional tillage, ridge-till, and no-till soybeans; double-cropped no-till wheat-soybeans; two no-till grain sorghum, one with hairy vetch for winter cover and the other with volunteer vegetation as winter cover; and two no-till cotton plots using wheat for winter cover on one and volunteer vegetation on the other. Annual plot runoff varied by as much as a factor of three with the no-till grain sorghum with hairy vetch winter cover producing the least runoff. The preliminary interpretation for this observation is that the vetch residue materially suppressed surface sealing otherwise common in the loessial soils of this study area. Watershed runoff (unit) magnitudes ranged from about 1.5 to 2 times comparable plot runoff. Results illustrate the significant influence on runoff of the interaction between watershed characteristics and agricultural management practice.

28. Studies relating the stage-discharge relationship of narrow strips (15- to 50-cm wide) of stiff grass were continued with lower flow rates and a number of additional grass accessions. The extended data set is being used to develop relationships between vegetation stem size, density, and distribution and hydraulic resistance for unsubmerged flow.

ARS-Mississippi

29. Cover crops are valuable in reducing erosion, building soil organic matter, and retaining nutrients. There use has been limited by the expense of planting each year. Studies are underway to screen legume germplasm and management techniques which allow winter annual cover crops to reseed themselves. Thrusts considered are: (1) early seed production each year and (2) hard-seed production once in selveral years. The ability of dense cover crop residues to reduce the costs of weed control in no-till cotton is also being investigated.

For additional information contact George R. Foster, Laboratory Director, USDA-ARS National Sedimentation Laboratory, P. O. Box 1157, Oxford, Mississippi 38655, telephone 601-232-2900, FAX 601-232-2915.

MISSOURI

AGRICULTURAL RESEARCH SERVICE

The Cropping Systems and Water Quality Research Unit in Columbia, Missouri is conducting research to develop conservation technologies for improving soil and water quality. Broad objectives include:

1. To better understand the relative influence of rainfall detachment, runoff detachment, and sediment transport in erosion from interrill areas

2. To determine the effects of prevailing and alternative farming systems on runoff, sediment yield, and water quality

3. To determine the effectiveness of narrow grass hedges in reducing rill-interrill and ephemeral gully erosion

4. To validate and improve the accuracy of model predictions from the Water Erosion Prediction Project (WEPP) Hillslope and Watershed models.

For more information, contact E. Eugene Alberts, Research Leader, USDA-ARS, 246 Agricultural Engineering Building, University of Missouri, Columbia, MO 65211.

NEBRASKA

AGRICULTURAL RESEARCH SERVICE

Research activities of the Soil and Water Conservation Research Unit at the University of Nebraska - Lincoln, include the following:

1. Conservation tillage systems help to maintain residue materials from the previous crop on the soil surface. The potential for serious erosion may exist if crop residues are removed by overland flow. This study was conducted to identify the hydraulic conditions required to initiate residue movement by overland flow. Corn, cotton, peanut, pine needles, sorghum, sunflower, and wheat residue were placed in a flume on smooth and sand surfaces, and flow was then introduced in progressive increments. The discharge rate and flow velocity required to initiate residue movement was identified. Hydraulic measurements were used to calculate the ratio of critical flow depth to residue diameter, critical Reynolds number, critical shear stress, dimensionless shear stress, and boundary Reynolds number. Regression equations were developed to relate dimensionless shear stress to boundary Reynolds number. Close agreement was found between predicted and actual dimensionless shear stress. If residue diameter is known, the regression equations can be used to estimate the beginning of motion for other residue materials. Information obtained in this study can be used to help identify proper residue management practices for conservation tillage systems.

2. A study was conducted to identify critical shear stress and critical flow rates required to initiate rilling on selected sites. The data used in this investigation were collected from soils located throughout the USA where crop residues had been removed, and moldboard plowing and disking had occurred. Runoff and soil loss measurements were made on sites where simulated rainfall was applied to preformed rills. Multiple regression analyses were used to relate critical shear stress values and critical flow rates to selected soil properties. The soil based regression equations were found to provide reliable estimates. Information identified in this study will improve our ability to understand and properly model upland runoff and erosion processes.

For additional information contact: James F. Power, Research Leader, USDA-ARS, University of Nebraska, Room 122, Keim Hall, Lincoln, NE 68583-0915.

OHIO

AGRICULTURAL RESEARCH SERVICE

The North Appalachian Experimental Watershed near Coshocton, Ohio has research related to:

1. Measuring the seasonal movement of sediment, nutrients, pesticides, and organic carbon over the surface and through the soil in sloping watersheds, and relating this movement to weather inputs, management practices associated with beef cattle production (pastures), and row crops (corn and soybeans) with conservation tillage.

2. Studying the influences of macropores (earthworm burrows and old root channels) on infiltration and the subsequent effects of reducing surface runoff and sediment movement.

3. Identifying and quantifying hydrologic and water quality processes and factors that are important for estimating surface and groundwater flows and chemical loads by using a well-instrumented, 7-acre natural lysimeter.

4. Developing a procedure for regionalizing storm hyetographs and testing the applicability of a method for estimating peak flows from small agricultural watersheds by using historic rainfall, climatological, and runoff records and computer simulations.

For additional information contact: L. B. Owens, Research Leader, USDA-ARS, North Appalachian Experimental Watershed, P.O. Box 478, Coshocton, Ohio 43812.

OREGON

AGRICULTURAL RESEARCH SERVICE

Research activities at the Columbia Plateau Conservation Research Center in Pendleton, Oregon include the following:

1. Studies are in progress to evaluate the movement of NO_3-N, NH_4-N, and total N from surface runoff samples collected over a 12 year period from the Kirk erosion site near Pendleton, Oregon. The project will determine the impact of two different management systems on nitrogen movement from fields.

2. A model has been developed to estimate surface and subsurface cereal residue decomposition. The required inputs are air temperature, initial residue amount and nitrogen content of the residue. The model is based on cumulative degree days above a base of 0·C. Decomposition data from Alaska, Idaho, Indiana, Missouri, Texas, and Washington were used to validate the model. Residues included winter and spring wheat and barley, durum wheat, triticale, corn, and soybeans.

3. No progress was made on the infiltration and agronomic effects of soil ripping and basin tillage while the soil is frozen because the soil did not freeze during the winter of 1991-1992. As a result, another field experiment was initiated. Tillage was accomplished after the soil was frozen and infiltration tests have been made. Preliminary results suggest that ripping increases infiltration rates when compared to the no tillage treatment.

4. Instrumentation was purchased for the generation, detection, and analysis of an acoustic spectrum from 20 to 10,000 Hz. This instrumentation will be used to develop techniques for the nondestructive measurement of soil surface porosity and roughness and to determine the stability of surface porosity as influenced by soil management systems.

5. Computer code for several models including KINEROS, CREAMS, and SPUR was obtained and testing to determine their efficacy in Pacific Northwest conditions has begun. Climatological data generation parameters have been extracted for 55 stations in Idaho, Oregon, and Washington for use in the SPUR weather generator. Weather and runoff data bases on CD-ROM are now available for model testing and verification. A geographical information system is in place for spatial analyses of precipitation, runoff, erosion, and frozen soils.

6. Field experiments were started to evaluate the soil and water conservation benefits of the stripper header method of grain harvesting. This new header strips the cereal heads and leaves the stems standing. Since the stubble using this harvesting method is much taller than that resulting from conventional harvesting methods, there is a possibility of reducing wind erosion and improving water storage efficiency.

For additional information contact John Zuzel, Hydrologist, USDA-ARS, Columbia Plateau Conservation Research Center, P. O. Box 370, Pendleton, OR 97801.

TEXAS

AGRICULTURAL RESEARCH SERVICE

Research activities at the Conservation and Production Systems Research Unit in Big Springs, Texas include:

A Vertical Still Air Tunnel (called VSAT) has been constructed by USDA-ARS engineers at Big Spring, Texas to determine particle size distrubution of airborne dust samples. The VSAT requires a 0.1 gm sample and provides the complete size distribution from 30 microns to over 600 microns. Approximately two minutes are required to analyze a sample.

For additional information contact Donald W. Fryrear, Supervisory Agricultural Engineer, Conservation and Production Systems Research, Cropping Systems Research Lab., P.O. Box 909, Big Spring, TX 79721-0909

TEXAS

AGRICULTURAL RESEARCH SERVICE

Research activities at the Grassland, Soil and Water Research Laboratory in Temple, Texas include:

A distributed parameter, continuous time model called SWAT (Soil and Water Assessment Tool) was developed to assist water resource managers in assessing water supplies and nonpoint source pollution on watersheds and large river basins. The model operates on a daily time step and can simulate several years of output. The model also allows a basin to be subdivided into hundreds of subbasins. The basin can be discretized into grid cells or natural subwatersheds. A command language was developed to route and add flows down through a watershed. Major components of the hydrologic balance are simulated including surface runoff, lateral flow in the soil profile, groundwater flow, evapotranspiration, channel routing, and pond and reservoir storage.

SWAT was validated on two different spatial scales: the small watershed and the river basin. At the small watershed scale, ARS station G (17.7 km^2) at Riesel, Texas is used for validation of water and sediment yields. The Lower Colorado River basin was simulated and compared to measured USGS streamflow data to test the model on a relatively large river basin (9000 km^2). Generally, simulated means and standard deviations compare well with measured values. Also at Station G at Riesel, the Nash-Stucliffe coefficients of efficiency are all between 0.70 and 0.80, indicating a reasonable goodness-of-fit. For the Lower Colorado River Basin, the coefficient of efficiency was 0.65 for annual flows and 0.60 for monthly flow comparisons.

SWAT provides the modeling capabilities of the HUMUS (Hydrologic Unit Model for the United States) project. The findings of this project will be used in the Resources Conservation Act (RCA) Assessment, conducted by the Soil Conservation Service, scheduled for completion in 1997. The major components of the HUMUS project are: 1) SWAT, to model surface and subsurface water quality and quantity, 2) a Geographic Information System (GIS) to collect, manage, analyze and display the spatial and temporal inputs and outs, and 3) relational databases needed to manage the non-spatial data and drive the models. The HUMUS project will simulate and validate approximately 350 6-digit hydrologic unit areas that have been delineated by the USGS for the 18 major river basins in the U.S.

For additional information contact J. G. Arnold, Agricultural Engineer, Grassland, Soil and Water Research Laboratory, 808 East Blackland Road, Temple, TX 76502.

WASHINGTON

AGRICULTURAL RESEARCH SERVICE

The following research is being conducted by the Land Management and Water Conservation Research Unit at Pullman, Washington:

1. Evaluation and testing of hydrologic models for the unique climate of the frozen soil affected areas of the Northwestern Wheat and Range Region is a continued effort at this location. The Agricultural Non Point Source (AGNPS) model is currently being tested with data collected from the Missouri Flat Creek watershed near Pullman, WA and the Tom Beall watershed near Lapwai, ID. All data are entered into a GIS that interfaces with the model. Data collection is complete on the Missouri Flat Creek watershed but is continuing on the Tom Beall watershed.

2. The hillslope version of the Water Erosion Prediction Project (WEPP) model is being tested using runoff and erosion plot data from the Palouse Conservation Field Station. The study is targeted toward improving performance of the winter routine of WEPP. This study is in cooperation with the ARS at Morris, MN and the National Soil Erosion Research Laboratory at West Lafayette, IN.

3. Relationships for the six factors of the Revised Universal Soil Loss Equation (RUSLE) have been developed specifically for the cropland of the Northwestern Wheat and Range Region. This will enable greater confidence in the use of RUSLE in this region of unique climate, topography and cropping conditions. Activity in 1992 concentrated on evaluation of alternative conservation practices.

For additional information, contact Donald K. McCool, USDA-ARS, Biological Systems Engineering, 219 L.J. Smith Building, Washington State University, Pullman, Washington 99164-6120.

The Hydrologic Engineering Center

Sedimentation activities at HEC during calendar year 1992 included some minor corrections and updates to computer program HEC-6, "Scour and Deposition in Rivers and Reservoirs" version 4.0, which was released in CY 91. Support to several applications by Corps district offices was also provided. To further support use of HEC-6, Training Document No. 13, "Guidelines for the Calibration and Application of Computer Program HEC-6", was updated and re-published. This document provides guidance on the engineering aspects of applying HEC-6. It is, therefore, a supplement to the HEC-6 User's Manual. TD-13 was first published in 1981; this update reflects recent improvements and expansions to HEC-6 and the applications experience gained in the past decade. It is compatible with the June 1991 (Ver. 4.0) release of HEC-6. It covers such topics as; understanding the historical behavior of the river system, data requirements, data acquisition, data assembly, data testing, calibration and confirmation, analysis of results, and computational considerations.

HEC finished work on a project for the Federal Emergency Management Agency (FEMA) that reviewed the performance of structural measures constructed to control flooding on alluvial fans. With the increased development in the arid western part of the United States, extensive development is taking place on alluvial fans. Many of these fans are exposed to extreme flood hazards associated with flash floods, mud and debris flows, high flow velocity, erosion and channel migration. The question being studied is: How well do typical flood control measures perform on alluvial fans, and how do we evaluate them? Field contacts were made and project reports reviewed. The draft report was reviewed by FEMA and will be finalized in CY 93.

Efforts under a research work unit titled "Land Surface Erosion" (which began in CY 91) resulted in a report titled "A Review of Watershed Erosion Models". That report documents contemporary land surface erosion models and summarizes information on their background, capabilities, availability, and computer requirements. This research is aimed at improving the analytical techniques used for developing project area sediment budgets to reduce the uncertainty in prediction of both long-term average annual sediment budgets and single flood event budgets.

Significant effort was expended to complete the final draft of Engineer Manual 1110-2-1416, "Streamflow Analysis" (commonly referred to as the river hydraulics EM). The purpose of the manual is to present techniques and procedures used to investigate and resolve river engineering and analysis issues and the associated data requirements. It documents past experiences that provide information for detecting and avoiding problems in planning, performing, and reporting future studies. Several authors contributed to the manual. It includes a chapter on computing "Water Surface Profiles with Movable Boundaries" and an appendix on "River Modeling - Lessons Learned".

In October an engineer from HEC participated in workshop on "Streams Above the Line - Channel Morphology and Flood Control" sponsored by the Corps' Flood Control Channels Research Program which focused on research and design issues for steep streams. HEC presented a paper titled "Numerical Simulation of

Mudflows from Hypothetical Failures of the Castle Lake Debris Blockage Near Mount St. Helens, WA". This paper documents a study that was performed by HEC to assess the impacts of hypothetical mudflow events that could possibly occur if the debris blockage presently containing Castle Lake were to fail. Various failure scenarios were investigated using numerical models for the debris blockage failure and routing of the resulting mudflow.

CORPS OF ENGINEERS

Waterways Experiment Station

Title of Study:

Beach Fill Engineering

Point of Contact:

Donald K. Strauble, CEWES-CD-SG

Conducted for:

U.S. Army Corps of Engineers

Water Resources Region:

Ocean City, Maryland with application to other beach nourishment projects

Objectives:

Study examined detailed monitoring data consisting of beach profiles, sediment samples and wave gage records of five years on the Ocean City, Maryland beach nourishment project. Two separate fills were placed, first by the State of Maryland in 1988 and Second by the U.S. Army Corps of Engineers in 1990. A series of three sever northeaster storms impacted the project three months after the first fill. Monitoring indicated that the fill was removed from the dry beach area but was deposited in the nearshore area with little loss to the project area. Two extreme events impacted the second fill at the end of 1991. These storms exceeded the 50 year design and again eroded material from the dry beach. Greater than 85% of the fill could be accounted for with in the nearshore area. Sediment grain size analysis showed resorting of the fill material over time to become like the native beach. The overfill ratio method of fill suitability over predicted the retention of fill on the dry beach, but under predicted the actual retention of fill in the nearshore.

Summary of Accomplishments:

A special issue of Shore and Beach summarizes the findings of this study and a Technical Report providing detailed analysis of project response is in press.

Title of Study:

Coast of Florida Erosion and Storm Effects Study

Point of Contact:

Donald K. Stauble, CEWES-CD-SG

Conducted for:

U.S. Army Corps of Engineers

Water Resources Region:

Coast of Florida

Objectives:

To develop a Geographic Information System (GIS) of geotechnical data that has been collected for nearshore sand resources. The initial data gathering and GIS development was limited to the southeast coast of Florida and included bathymetry, sediment sample locations, core boring locations, seismic tract lines, sand thickness isopacts and hardbottom locations in the nearshore shelf from the shoreline to the 100 ft depth contour. Areas of missing data were identified and additional bathymetry and sediment cores were collected and analyzed in these areas.

Summary of Accomplishments:

All existing geotechnical data was archived for southeast Florida coast and GIS data base design was designed. Maps of specific geotechnical data were generated.

Title of Study:

Field Tests of Sediment Transport Theories

Point of Contact:

Thomas E. White, CEWES-CD-P

Conducted for:

U.S. Army Corps of Engineers

Water Resources Region:

All Coastlines

Objectives:

Objective tests of theories used in CERC sediment-transport models will be provided with experimental backing for recommendations of changes in theories. Experimental confirmation of recommended methods Districts should employ in estimating longshore sediment transports should significantly improve Corps coastal design.

Summary of Accomplishments:

Data reduction has been completed on all data sets. First draft of total-load publication has been written.

Title of Study:

Mouth of the Colorado River, Texas

Point of Contact:

Thomas E. White, CEWES-CD-P

Conducted for:

U.S. Army Corps of Engineers

Water Resources Region:

All Coastlines

Objectives:

Measure waves, currents, and sediment transport at the site in order to test assumptions made in project design (jetty and weir length, sediment bypassing efficiency), more accurately predict maintenance types and costs (dredging frequencies and amounts), and improve future design of similar Corps projects. An important specific goal is to accurately calibrate long-shore transport formulas for this site, allowing more accurate estimates of longshore sediment transport and inlet shoaling rates from directional wave measurements in the future. This should result in better predictions of dredging requirements and substantial dredging cost savings.

Summary of Accomplishments:

Completed three major field experiments using state-of-the-art electronic instrumentation systems specifically developed for this project. Continued reduction of field data and calculations to define sediment transport quantities/pathways. A major effort has been made to compare sediment transport from two different methods: surf zone experiments and shoaling wave data (SPM formula). This was the first research effort to use both methods at the same site and compute error bars on both.

Title of Study:

Sediment Transport Instrumentation for the Littoral Environment (STILE)

Point of Contact:

Thomas E. White, CEWES-CD-P

Water Resources Region:

All Coastlines

Objectives:

Develop methods to accurately and reliably measure sand transport in the littoral environment. Such methods must not interfere with the process being measured. In practice, this will entail development of sensors which measure sand transport on small temporal and spatial scales, which then can be integrated to scales of interest.

Summary of Accomplishments:

A STIEL workshop was held during the AGU meeting to assess the results of Phase I and review proposals for Phase II. Three STILE contractors formally presented their results to AGU. Long-term development programs were initiated for Sediment-Transport Optical Micro Probe (STOMP), Coherent Acoustic Sediment-Flux Probe (CASP), and an optical mass-flux sensor based on enhanced OBS technology.

Title of Study:

Kings Bay Coastal Monitoring Program

Point of Contact:

Ms. Laurel T. Gorman, CEWES-CD-SG

Water Resources Region:

Southeast Georgia and Northeast Florida

Objectives:

As part of the Kings Bay Coastal Monitoring Program, sediment data was collected along selected beach profiles representative of major geomorphic compartments. Sampling extended in the cross-shore direction from the dune to the depth of closure around the -6 m depth contour on the entire length of both Cumberland and Ameilia Islands. The purpose of this study was to document the sediment characteristics of large scale coastal processes study in support of the U.S. Navy navigation needs.

Summary of Accomplishments:

Data reduction and summary statistics have been completed for the entire five-year data monitoring period (1988-1992). Data will be published in a Technical Report of the Kings Bay Project, which is now in final edit stage.

Title of Study:

Scour Holes at the End of Str

Point of Contact:

Steven Hughes, CEWES-CW

Water Resources Region:

All Coastlines

Objectives:

This research is aimed at pro

Title of Study:

Laboratory Studies on Scour

Point of Contact:

Jimmy E. Fowler, CEWES-CW-P

Water Resources Region:

All Coastlines

Objectives:

The objective of this work unit is to elevate movable-bed physical modeling to the point that it can be considered a useful and reliable quantitative tool to aid in investigations of coastal phenomena. Emphasis is placed on developing or refining modeling guidance relating to scout, onshore/offshore transport, beach profile evolution, and sedimentation at structures.

Summary of Accomplishments:

Two-dimensional tests on scour in front of vertical seawalls were completed. Numerous bugs in the automated bottom profiler were detected and resolved. The bottom profiler was used to obtain profiles for all of the additional monochromatic wave tests which were done to document differences in scout depth for regular versus irregular waves. A test series was initiated to provide guidance for evaluating scour potential and design for scour at rubble mound structures. Drafts were completed on the scour predication methods technical report, a miscellaneous paper on scour at vertical seawalls, and an outline for a CETN on scour prediction methods.

Title of Study:

Shoreline and Beach Change Modeling

Point of Contact:

Bruce A. Ebersole, CEWES-CR-P

Water Resources Region:

All Coastlines

Objectives:

To develop and transfer well-tested and documented shoreline and beach topography response models to field offices. To provide model documentation (including user's manuals, workbooks, and PC models). To provide expert consulting services and training (workshops) to field offices. To enhance and refine GENESIS (GENEralized model for SImulating Shoreline change) and SBEACH (Storm-induced BEAch CHange model) and develop the next generation of shoreline and beach topography response models, 3DBEACH.

Summary of Accomplishments:

The Instruction Report "User's Manual: Shoreline Modeling System (SMS)" was published. This is the last in a series of three scheduled documents that describe the shoreline change modeling tools produced in the R&D program. Completed draft SBEACH user's manual, and distributed software and manual to the field for testing and evaluation. A workshop was held in November 1992 to transfer state-of-the-science shoreline and beach change models to the field engineers. Continued analysis of wave and shoreline/beach change data at Oregon Inlet, North Carolina, and Ocean City, Maryland. Data are being used to improve existing models and develop and test the next generation of beach topography response models, 3DBEACH.

Title of Study:

Monitoring Completed Coastal Projects (MCCP) - St. Joseph

Point of Contact:

Larry Parsons, CEWES-CD-SG

Water Resources Region:

Southeastern coast of Lake Michigan

Objectives:

The main objective of this study is to determine if current methods for evaluating native beach sediment characteristics are applicable in locations where coarser grained particles are present. Also of interest is to stratigraphically examine cohesive sediment layers immediately underlying beach areas in order to resolve the importance of armoring the fine grained shoreface with coarse grained fill material. An evaluation of the improved retention of coarser fill material and additional benefits gained in stabilizing the beach using coarse fill is part of this research. Mechanisms and rates of coarse fill movement alongshore are being documented to assess down drift benefits of using coarse fill for beach nourishment.

Summary of Accomplishments:

Surface sediment samples were collected and grain size analysis was done for the St. Joseph, Michigan beach fill project monitoring plan. Profile surveys were collected for analysis of cross shore and longshore movement of fill material. Ground Penetrating Radar (GPR) data also was collected to determine thickness of sand and travel overlying cohesive glacial till sediment. Sediment borings were also performed for validation of GPR for use in the Great Lakes.

Title of Study:

Demonstration Erosion Control (DEC) Monitoring Program

Point of Contact:

Nolan Raphelt

Water Resources Region:

Northwest Mississippi Watersheds

Summary of Accomplishments:

Two video reports were produced, describing the erosional problems existing in northwest Mississippi watersheds, encompassing an area of about 2,000 square miles. The video reports also describe the systematic engineering approach being taken to reduce or eliminate the problem. The purpose of the monitoring program is to evaluate the effectiveness of the various engineering solutions, such as high- and low-drop grade control structures, in reducing the sediment problem and develop design tools for sediment reduction studies. The program includes the development of an engineering database/GIS designed to facilitate the sedimentation evaluation process. A draft Technical Report describing FY 92 activities with conclusions and recommendations was completed.

Title of Study:

Mississippi River at Redeye Crossing Numerical Model Study

Point of Contact:

Nolan Raphelt

Water Resources Region:

Lower Mississippi River, Louisiana

Summary of Accomplishments:

The purpose of the study is to evaluate the effectiveness of training dikes at Redeye Crossing in reducing maintenance dredging requirements. A two dimensional numerical sediment model (TABS-2) has been developed and adjusted. A number of dike plans consisting of four to eleven submerged lateral rock dikes have been tested. The testing procedure includes dynamic, year-long simulations using an average annual hydrograph. ASCE and WEDA papers describing the modeling approach have been published and a draft Technical Report with results completed.

Title of Study:

Albuquerque Arroyos Sedimentation Study

Point of Contact:

Ron Copeland

Water Resources Region:

Southwest US

Summary of Accomplishments:

The purpose of the study was to evaluate the sedimentation impact of proposed flood control design features on the Albuquerque Arroyos project. A sediment transport model, HEC-6, is being used to predict aggradational trends under various plan conditions. As part of the study, a geomorphic assessment is being conducted under contract, and watershed sediment yield issues are being addressed. A Technical Report describing the study results, with conclusions and recommendations, will be published.

Title of Study:

Abiaca Creek, Mississippi Sedimentation Study

Point of Contact:

Gary Freeman

Water Resources Region:

West central Mississippi

Summary of Accomplishments:

The purpose of the study was to evaluate the sedimentation impact of proposed flood control levees on lower Abiaca Creek. A 1D sediment transport model, HEC-6, was used to predict long term (30 years) aggradational/degradational trends under the plan condition. A Technical Report with model results and recommendations was published.

Title of Study:

Conemaugh River Lake Sedimentation Study

Point of Contact:

Gary Freeman

Water Resources Region:

Conemaugh River, Pennsylvania

Summary of Accomplishments:

The purpose of the study is to evaluate schemes for reducing deposition rates in the lower portion of the reservoir so that the structure gates can be operated when needed. Site reconnaissance was conducted. The modeling approach developed used the unsteady flow model UNET to perform the hydraulic computations and the HEC-6 sediment transport model as a known-discharge model to perform the sedimentation analysis. An ASCE paper describing the modeling approach has been published and a draft technical reported with results completed.

Title of Study:

Mississippi River at Old River Numerical Sedimentation Study

Point of Contact:

Brad Hall

Water Resources Region:

Lower Mississippi River

Summary of Accomplishments:

The purpose of the study is to predict the transport rate of sand-size sediments from the Mississippi River into three lateral perched channels; 1) the Vidalia hydropower entrance channel, 2) the Old River Control Structure entrance channel, and 3) the Auxiliary Control Structure entrance channel. This information is needed to manage the distribution of sediment between the Mississippi River and the Atchafalaya River systems. The problem is highly three dimensional, requiring the use of a 3D numerical model. Also, dynamic long term simulations are required for testing. The model selected for use was the 3D boundary-fitted finite difference model CH3D. The University of Iowa under contract has developed the appropriate sediment transport module and installed it in CH3D. Testing of the sediment transport coding on the Mississippi River model is underway.

GEOLOGICAL SURVEY, CORPS OF ENGINEERS, BUREAU OF RECLAMATION, FEDERAL HIGHWAY ADMINISTRATION, BUREAU OF LAND MANAGEMENT, AGRICULTURAL RESEARCH SERVICE, FOREST SERVICE, AND TENNESSEE VALLEY AUTHORITY

Federal Interagency Sedimentation Project

During FY 1992, the Federal Interagency Sedimentation Project completed its reorganization by moving its equipment and inventory from the Saint Anthony Falls Hydraulic Laboratory to the U.S. Army Corps of Engineers Waterways Experiment Station (WES) in Vicksburg, Mississippi where sediment-instrumentation research and equipment-coordination activities will be directed by Wayne O'Neal (WES). During FY 93, equipment sales and contractual arrangements for procuring equipment will become the responsibility of the Tennessee Valley Authority (TVA) through its office in Knoxville, Tennessee.

Equipment sales for the entire FY 92 were $69,900. For the first quarter of FY 93 they were $14,800. To meet increasing costs of procurement, the Interagency Technical Committee approved a ten-percent increase in equipment charges.

The design and use of sampling equipment took on a new dimension with the growing emphasis on sampling for trace metals in rivers. Samplers with critical parts made of fluorocarbon plastics are in demand because of stringent requirements set by the U.S. Geological Survey (USGS).

Several aspects of sediment research were presented by WES researchers to the Technical Committee. Interest in acoustic techniques for measuring bedload discharge is a high-priority item that Richard McGee (WES) will pursue by solicitation of technical preproposals, review of present technology and evaluation of existing facilities. At least one meeting to discuss this approach and evaluate technical merits of the research will be conducted.

Reorganization has highlighted needs for formal agreements covering the Sedimentation Project. To meet this need, Douglas Glysson (USGS) drafted an Interagency memorandum-of-understanding describing Project organization, funding and agency participation. The document is currently in review status. Bob Strand, U.S. Bureau of Reclamation (USBR), led a task group charged with preparing a ten-year plan describing the Project's long-range mission and objectives. The document, which was approved by the Technical Committee at its April 12-15, 1992 meeting at the Stennis Space Center, Mississippi is slated for submission to the Subcommittee on Sedimentation.

A survey of USGS offices conducted by Harvey Jobson (USGS) indicated a need to improve existing Project samplers and to design new samplers that not only collect representative sediment samples but also maintain chemical integrity.

Priorities for the Project's research and development activities were established by the Technical Committee at its October 20-21, 1992 meeting in Knoxville, Tennessee. With the first item ranking highest, the tasks are (1) Develop a nozzle-calibration stand. This is a quality-control tool for accurately measuring head-loss through sampling nozzles. (2) Finish developing the plummet gage. This is a field-based experimental instrument for measuring

sediment concentrations. TVA personnel have nearly finished the control module but testing of the pumping unit remains. (3) Investigate sampling bias in D-77 samplers. Some field data indicate sampled concentrations are low which may be caused by the sampler's large unsampled zone. (4) Conduct exploratory research on acoustic techniques for measuring bedload. (5) Field-test external valves for D-77 samplers. These valves are special devices to minimize the risk of trace-metal concentration. (6) Develop core retainers for the Project's hand-held core samplers. (7) Develop a lightweight pumping sampler. (8) Develop a bed-roughness gage for use on cobble-lined channels. (9) Test a new acoustic sediment-concentration meter. (10) Develop a sampler for use in low velocities. (11) Improve reliability of P-61 sampling valves. (12) Develop a suspended-sediment sampler for use near stream beds.

TITLE

Movement and Storage of Sediment in River Systems (CR 75—102)

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Problem

Sediment moves through a river system in response to specific events and changing conditions in the drainage basin. The movement of sediment is usually discontinuous. Episodes of movement are separated by periods of storage that can range from less than 1 year to more than 1,000 years. Understanding the movement and storage of sediment in rivers is important to navigation, flood control, and other aspects of river engineering, as well as to the prediction of the fate of contaminants absorbed on sediment particles.

Objective

Assess (1) changes in river-sediment loads over periods of decades or longer and the factors (natural or artificial) that cause the changes; (2) rates at which sediment is stored in river systems and the residence times of sediment particles in storage; and (3) sources, pathways, and sinks of sediment particles in river systems.

Approach

(1) Assess long-term changes in sediment loads from data previously collected by U.S.Geological Survey and other agencies; (2) assess sediment storage by repeated (annual) surveys of selected river channels and by comparing old and new maps and aerial photographs of rivers and their flood plains; and (3) assess sources, pathways, and sinks by intensive field studies of selected large and small rivers.

Progress

Two sampling cruises were completed on the Mississippi River between Minneapolis, Minnesota, and New Orleans, Louisiana. A resurvey of cross sections in Powder River, Montana, showed a moderate amount of channel change since last year. Meanders in Powder River are cut off mainly by upriver erosion of headcutting gullies across meander necks.

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TITLE

Effects of Water and Sediment Discharges on Channel Morphology (CR 65—105)

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Problem

Channels on alluvial streams change with time. Bed elevations and channel widths may change, meander bends shift both laterally and downstreamward, the sizes of the bed particles may change, instream bars grow and migrate, and the amount and type of vegetation along the river may increase or decrease. Sometimes the change is minor and insignificant, even over decades, but in other cases catastrophic modifications occur in minutes. The transformations can be natural or man-induced, and they can have significant effects on man and the environment.

Objective

To determine and analyze the influence of the major governing variables, particularly water and sediment discharges, on channel morphology, and to evaluate how the many relevant variables and results change with time.

Approach

(1) Identify the major variables that govern channel morphology; (2) Obtain data sets that span as long a time period as possible; (3) Isolate the effects of different variables and analyze stream channels as dynamical systems, with an eye toward prediction of channel changes.

Progress

Applicability of standard time-series analysis to chaotic systems was explored. Most studies in which data have been analyzed for possible chaos do not incorporate the usual tools of time-series analysis, probably because investigators are not aware of the applicability of such tools. Metric (Kolmogorov-Sinai) entropy is one of the critical indicators of chaos but unfortunately cannot be calculated for most data sets because data sets must be exceedingly large (on the order of tens of thousands or even millions of observations). Furthermore, it is an indicator that is poorly understood by many investigators. One of the most common procedures in chaos analyses is a calculation of Lyapunov exponents. However, even that tool suffers from the limitation that, with real-world data, only the non-negative exponents can presently be determined. All of the above-mentioned analyses are made difficult by the ever-present noise. I am exploring the possibility of applying chaos theory to channel morphology.

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TITLE

Hydraulics and Mechanics of Bedload-Transport Processes (CR 74—187)

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Problem

Of all processes operating in river channels, and especially of those of practical concern to engineers and others interested in river-channel behavior, perhaps the least information is available regarding the hydraulics and mechanics of bedload transport. As scientific knowledge of river behavior advances and is applied to management of the nation's rivers, additional understanding of bedload-transport processes will be necessary.

Objective

(1) Define (a) spatial and temporal variations in transport rate and particle size of bedload; and (b) the average magnitudes of transport rate and particle size throughout a range of geographic locations, channel geometries, and river hydraulics. (2) Evaluate the adequacy of sampling equipment and field procedures, provide interpretation of bedload-transport processes, and assess the applicability of existing or new predictive techniques in river hydrology. (3) Demonstrate the value of sediment data in designing hydrologic networks and in evaluating regional and temporal trends in water-resources information. (4) Assess the usefulness of numerical simulations as hydrologic tools in fluvial geomorphology. (5) Provide interdiscipline perspectives in evaluation of environmental resources (for example, fishery habitat), impact assessments (for example, alluvial mining), and management alternatives (for example, operating policy). (6) Apply the information to operational programs of the USGS and other organizational units to assist in the solution of practical problems.

Approach

(1) Use continuous sampling of bedload (for example, conveyor-belt bedload trap on the East Fork River near Pinedale, Wyoming) as a control to evaluate spatial and temporal variability factors in bedload transport and to evaluate general relations between sediment movement and river hydraulics. (2) Field calibrate the sediment-sampling efficiency of the Helley-Smith bedload sampler simultaneously with operation of the bedload trap. (3) Use the calibrated Helley-Smith sampler and the concurrent measurements of streamflow hydraulics in the systematic collection of bedload samples from a variety of sand- and gravel-bed streams, and within the laws of general physics, stochastically develop empirical relations of bedload transport and interpret the physical significance of the developed relations. (4) At the conveyor-belt bedload-trap research facility, initiate a tracer study using fluorescent particles (sand to fine gravel) to evaluate (a) residence time of sediment; (b)

average speed of various sizes of particles; (c) depth of bed material involved in transport; (d) dispersion of bed material; (e) short-term channel changes accompanying sediment transport; (f) influence of availability of sediment on transport rate; and (g) other related aspects of sediment transport. (5) Extend the fluorescent-tracer study to larger particles (coarse gravel to cobbles) by implanting microradio transmitters in individual rocks and, by periodic and (or) continuous detection by receivers/data loggers, provide time-sequence data on motion and location of separately identifiable particles. (6) Establish field sites for bedload sampling that document varying characteristics of geographic coverage (factors of hydrology, meteorology, soils, biology, and so forth); maintain one or more bedload stations as long-term observation sites so that time-trend data can be evaluated. (7) Initiate and participate, as needed, in studies comparing sampler types, sampling procedures, and analytical techniques to formulate and modify guidelines on equipment needs and field/laboratory practices; provide emphasis on relevancy to WRD mission and on need for consistency of data collection. (8) In conjunction with biologists, chemists, and other scientists, develop a field-oriented strategy for comprehensive environmental assessments; apply developed strategy to specific sites to demonstrate and document sediment-related variables as important ecological factors.

Progress

(1) Field work at the bedload trap and for the fluorescent-tracer study is complete. Bedload-transport rates measured synoptically, vary along a river reach; bedload tonnage, measured seasonally, is about constant throughout the reach. Mean bedload-transport rates relate to streampower (about the 1.6 power of streampower in excess of streampower at initiation of motion), mean bedload-particle speeds are slow (about 0.1 percent of water speed), and lengths of particle movement may be seasonally limited. (2) Radio transmitters were implanted in cobble-size rocks and movements tracked as part of studies on Toklat River, Lignite Creek, and Phelan Creek, Alaska. Bedload-transport rates relate about to the 1.6 power of discharge in excess of discharge at initiation of motion and particle size (mean, modal, and maximum) increased as transport rate increased. Motion sensors allow distinction between periods of motion and periods of inactivity. Generally, brief periods of motion are followed by longer times of rest. Large moving particles (about fist size) travelled about the same distance as smaller particles (about golf-ball size). Particle speeds and distances travelled are in general agreement with observations from East Fork River, Wyoming. (3) Long-term data collection continued for the 10th year at Little Granite Creek, Wyoming (in cooperation with the Idaho District, USGS). Although measured total-sediment loads are among the longest data sets available at a continuous-record gage, the period of record is still short to forecast time trends. Generally, during the period of observation, water runoff has decreased and sediment yields have lessened more dramatically. These facts may be related to short-term weather variability rather than to long-term climate change. (4) Comparisons of equipment and procedures were continued in collaboration with personnel in other countries and from other USGS offices. This was highlighted by a month-long visit to the PRC (under the USA—PRC Protocol) to evaluate bedload equipment and sampling techniques. (5) In collaboration with other USGS scientists and academia personnel, environmental assessments were conducted on several streams in Yellowstone and Denali National Parks, Wyoming and Alaska. A field procedure to evaluate habitat quality was developed combining geomorphic aspects (river hydraulics, sediment characteristics, topography), water chemistry (pH, conductance, trace elements, organic

carbon), and biological factors (benthic drift, invertebrates, fish). (6) Studies of phytoplankton taste and odor problems were established on Fremont Lake; interpretations are complete and a report is in press.

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TITLE

River Mechanics (CR 82—273)

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Problem

The geometry and pattern of river channels adjust to significant changes in the water discharge, size, and quantity of sediment supplied to the channel. When the quantity of water and sediment over a period of years remains relatively constant, the channel geometry and pattern vary about a mean or quasi-equilibrium condition. Major watershed alterations that change the supply of water, sediment, and size of sediment reaching the channel necessitate an adjustment of the channel geometry and pattern. That is, the channel is transformed from one quasi-equilibrium state to another. Between the two quasi-equilibrium states, there is a period of instability and adjustment. Existing techniques for examining and predicting river channel adjustment have been developed primarily from investigation of quasi-equilibrium rivers. As a result, it is frequently possible to predict with a modest range of uncertainty the future quasi-equilibrium hydraulic characteristics of a river following a change in its watershed. The dynamics and rate of river channel adjustment during the period of instability, however, have rarely been studied, and are rather poorly understood. The length of time required for the complete adjustment is commonly a few decades to a century or more. In many instances, such as surface mines, reservoirs, and urbanization, the adjustment period may, in fact, be longer than the duration of the watershed change. In watersheds where various land-use changes occur every several years, river channels may be continually adjusting to different contributions of water and sediment, and thus, never reach a quasi-equilibrium condition. In these rivers, instability and adjustment are the prevailing condition. The primary focus of this research project is to understand the dynamics and rate of river channel change and develop numerical models to make predictions of river channel characteristics given a particular change in flow regime and sediment supply. The greatest deficiencies in our present knowledge of river channel adjustment are (1) the longitudinal sorting of bed material, especially gravel, (2) the formation and stability of bed forms, (3) adjustment of channel width through the erosion and deposition of bank material, and (4) the rates at which the several hydraulic variables adjust.

Objective

Develop physically-based numerical models to describe the processes and rate at which a river channel adjusts in response to a change in the water discharge, sediment size and sediment load supplied to the channel. Emphasize the adjustment of those aspects of river channels known to significantly influence the aquatic ecosystem, that is, the bed-material size distribution, occurrence of bars, and channel width. Describe the

hydraulic processes controlling these characteristics of river channels as well as the rate at which they function. Formulate mathematical models of the processes as required for longitudinal routing of water and sediment. Develop new analytical tools for describing river-channel adjustment.

Approach

The development of physically-based hydrodynamics models involves an iterative process of model formulation, testing model predictions using field and laboratory measurements, and then model refinement. Precise field and laboratory measurements are essential. Ideally, one would study in great detail the transition of a river channel from one quasi-equilibrium state through a period of instability to another quasi-equilibrium state as a result of a known change in the supply of water and sediment. Unfortunately, this approach is impractical for several reasons including the need to maintain a high level of effort over the period of adjustment, which may last for a few decades to a century or more. Instead, one must limit the detailed study of processes to a duration much less than would normally be required for channel adjustment. These studies, however, can lead to a precise description of physical processes. Although historical information is incomplete and less precise, the course and rate of river channel adjustment through time can only be understood by studying historical examples. Thus, reconstructions of the sequence and rate of channel adjustment using historical examples of river channel change are necessary components of this research. Better understanding of river channel adjustment requires a combination of precise field and laboratory studies, the reconstruction of historical examples using available information, and carefully formulated physically-based models.

Progress

During the 1991 fiscal year, significant progress has been made on several topics of on-going research: (1) the nature of flow over bed forms, (2) incipient particle motion and marginal sediment transport of coarse material in natural streams, and (3) the nature of circulation and sediment accumulation in lateral separation eddies. A cooperative effort with the University of California at Santa Barbara concerning the nature of flow and turbulence structure over two-dimensional bed forms was initiated in 1989. A series of laboratory flume studies was begun in August 1990. Analysis of a portion of the laboratory measurements has been completed, which provides a much improved description of turbulent stresses over bed forms. These results, also, lead to a very precise method for calculating the flow velocity profile and the equilibrium amplitude of bed forms. A manuscript has been submitted for publication. A model for marginal bed load transport was derived where the transport rate is given by the product of the particle mass, the number of particles in motion per unit area, and other particle velocity. Both the number of particles in motion and the particle velocity are specified functions of the dimensionless shear stress and particle size. The effects of boundary roughness, particle shape, particle orientation, and packing of bed particles are also specified, in order to determine the number and velocity of bed particles in motion. Predicted bed load transport rates using the model are in good agreement with laboratory flume measurements for three sizes of uniformly sized bed material, 2.5 mm, 7.95 mm, and 22.2 mm, described by Paintal (1971). The study of lateral separation eddies consists of a combination of field, laboratory, and theoretical work aimed at understanding the mechanics of flow and sediment transport in eddies. One flume experiment has been completed, and several locations have been studied and analyzed for their suitability as a

comprehensive field study. A numerical model has been developed for computing the deposition rate of sand throughout a lateral separation eddy. The model solves the advection-diffusion equation for a mixture of suspended sand-sized sediment. These computations demonstrate that eddies are typically very effective sediment traps, because the Rouse number of an eddy is commonly one-fifth to one-tenth of the value in the primary channel and the residence time of water in the eddy is large compared to the ratio of the flow depth to the particle settling velocity. Typically, deposition rate for a river such as the Colorado River is several centimeters per day at discharges near the mean annual peak.

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TITLE

Sediment-Transported Pollutants in the Mississippi River (CR 87—309)

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Problem

The source and fate of many pollutant substances in the Nation's largest river system are closely tied to suspended sediment. Accurate prediction of the fate of these pollutants will require more than our present understanding of the interactions between sediments and pollutants and the ways in which large rivers store and remobilize suspended sediment.

Objective

Define and understand (1) processes by which pollutant substances, organic and inorganic, are adsorbed onto sediment particles; (2) downstream mixing of pollutants below the confluence of large tributaries with the mainstem; and (3) seasonal storage and remobilization of sediment and pollutants in the Mississippi River system.

Approach

One to two boat trips per year, beginning at Minneapolis, Minnesota, and ending at New Orleans, Louisiana, will be made to sample 15—20 cross sections of the Mississippi River and its principal tributaries. Cross sections will be sampled with a large-volume suspended-sediment sampler by the equal-width-increment method. Suspended sediment will be concentrated and analyzed for a large number of organic and inorganic constituents, both natural and manmade. New methods for sampling and analyzing pollutants attached to sediment particles will be developed in the field and in the laboratory.

Progress

Two full-scale chemical sampling trips were made on the Mississippi River between Minneapolis and New Orleans during September—November 1991 and March—May 1992, bringing to 10 the final number of such cruises made during 1987—92. Representative composite bed-material samples were collected from 25 of the navigation pools of the upper Mississippi. The herbicide atrazine was present in all samples collected from the Mississippi River and its tributaries, and it reached concentrations in excess of MCL in several tributaries during the herbicide-application season. Industrial organic compounds are adsorbed onto suspended-sediment and bottom-sediment particles in the river: the distributions of some, like hexachlorobenzene, reflect source areas in the Ohio River and in the Lower Mississippi River below Baton Rouge; the distributions of others, like PCBS, show how sediment in the river can be ho-

mogenized by successive years of deposition and resuspension.

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TITLE

Sediment Impacts from Disturbed and Undisturbed Lands (CR 79—311)

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Problem

The acquisition and meaningful interpretation of sediment data from areas disturbed by land-use activities or natural processes is one of most deficient areas of recognizing nonpoint-source pollution in the United States. The comparison of sediment data from disturbed and undisturbed areas provides a means to (1) evaluate the effects that land-use activities cause, (2) investigate the geomorphic processes that regulate the detachment and transport of sediment, and (3) develop strategies for remedial action to reduce excessive sediment discharges. This information is especially necessary to minimize sediment discharges and sorbed chemical loads from surface-mine, industrial, agricultural, and urban areas.

Objective

(1) To evaluate the extent and utility of sediment data from a variety of land-use areas, (2) to predict the movement of sediment from drainage basins affected by those land uses, and (3) to assess existing techniques and develop new ones based on geomorphic principles and the application of statistics, geochemistry, and botany to the limited data available as aids in improving our interpretive capabilities.

Approach

Field investigations are being conducted to evaluate available techniques for predicting sediment yields. Of particular interest are the Water Erosion Prediction Project model and the U.S. Department of Agriculture (USDA) rainfall simulation model. Research is to be conducted to develop technology for determining (1) predisturbance sediment-delivery ratios (proportion of gross erosion that appears as sediment yield at some place in the watershed) based on factors such as land use, contributing drainage area, runoff, basin morphology, relief, vegetation, and geochemical tracers, (2) sediment yields during disturbance, which are influenced by sediment-control measures used during land-use activity, and (3) sediment-delivery ratios for the post-disturbance period. In cooperation with other agencies and field offices of the Survey, available sediment and related hydrologic and chemical data are being acquired and interpreted to develop techniques and possibly models to aid in the prediction of sediment impacts from land disturbance.

Progress

The USDA rainfall-simulation model was combined with geomorphic field techniques to yield estimates of total annual runoff and

ground-water recharge in watersheds of the United Arab Emirates and the Amargosa River basin (as part of the Nuclear Hydrology Program). These methods are first steps towards developing quantitative water-budget estimates and eventually sediment discharges from undisturbed watersheds of arid and semiarid areas. A second USDA model, the chemicals, runoff, and erosion from Agricultural Management Systems model, was also used to develop a technique to estimate upland or cultural groundwater recharge during infrequent events of heavy precipitation. The combined results of the two techniques provide estimates of total mean annual recharge.

For many watersheds a large portion of total sediment discharge occurs in less than 1 percent of time. Sediment discharge, geomorphic changes and vegetation changes are being studied in the Plum Creek basin, Colorado, following an historic flood in 1965. Substantial progress has been made in understanding the distribution of flood deposits in study reaches, relating the 1965 event to the paleoflood record, defining total-load sediment discharges in the basin, and understanding the reestablishment of willow and cottonwood trees along Plum Creek.

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TITLE

Sediment-Water Chemistry in Large River Systems: Biogeochemical, Geomorphic, and Human Controls (CR 88-313)

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Problem

Rivers are a major pathway to the ocean for erosion products and human wastes. The mechanisms that control the composition of river-borne materials are only imperfectly understood because erosion and the subsequent transport of material by rivers are mediated by a wide variety of closely linked chemical, biological, and physical processes. Moreover, in developed river systems such as those in the United States, these processes are subject to pervasive human-related perturbations. There is a need to develop, through field and theoretical studies, a comprehensive and integrated description of these processes for large river systems in a form that is useful to researchers in many disciplines.

Objective

Describe how the biogeochemical and physical aspects of erosion and transport processes are reflected in the composition of river-borne materials for particular large river systems and develop general theoretical models that can be applied to rivers in general; evaluate the extent to which human activity has affected the river systems. Study how various chemical phases, natural or human-introduced, organic or inorganic, are partitioned between solid and dissolved loads in rivers and estuaries as the result of weathering, particle-surface reactions, biological uptake or release, atmospheric exchange, and storage during transit. Evaluate the dispersal pathways of river-borne substances through river systems and estuaries into and across the coastal marine environment.

Approach

Assemble, primarily from maps and data bases, current and historic chemical, geomorphic, biological, and demographic data for an entire river system. Identify phenomena that are especially important in controlling the composition of phases containing the major elements (H, C, O, Na, Mg, Al, Si, S, Cl, K, Ca, Ti, Fe) and certain minor indicator elements (N, F, P, Mn, Sr, Zr) to provide the conceptual framework for solving specific research objectives. Undertake field surveys, design sampling and analytical procedures, and create computer tools to manipulate and model data as part of these investigations. Formulate small scale field and laboratory studies to aid data interpretation as deemed necessary.

Progress

In FY 1992, project efforts concentrated on investigations of weathering and erosion processes, nutrient cycles, and gas exchange in small tropical watersheds. This research is related to the USGS Global Change Program. Sites are in northeastern Puerto Rico, at the Luquillo Experimental Forest (LEF), and in central Panama, at the Barro Colorado Nature Monument (BCNM). Work at the LEF is funded under the Water, Energy, and Biogeochemical Budgets (WEBB) Program of the USGS—WRD. The Smithsonian Tropical Research Institute shares funding for the work in Panama. These studies are designed to compare geologically matched natural and developed environments. The studies of weathering and erosion use long-term chemical sampling and physical monitoring to characterize the processes that control the distribution and transport of major, important-minor, and nutrient elements through soils, downslope, and out of the watershed. Phenomena of interest to global-change research include the fixation, storage, and export of carbon and nutrients as related to biogeochemical and geomorphic processes within the watersheds. During FY 1992, the sampling and analysis of samples from selected rivers began in both Puerto Rico and Panama. In addition, regular samples of precipitation, soil water, and surficial runoff are being collected and analyzed. Collection apparatus and monitoring equipment have been installed for event sampling in most of these streams, and preliminary event sampling has begun. By the end of the fiscal year, elemental analysis of all sediment, soil, and bedrock samples collected from these watersheds will be completed. In addition to this work in Puerto Rico, exploratory work is to be done on collecting a smaller but similar series of samples from South Cascade Glacier in Washington. The glacial basin has high runoff and bedrock similar to that in the study watersheds of Puerto Rico. There is, however, virtually no vegetation, thus it may be possible to distinguish purely chemical weathering processes from those that are biologically influenced.

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TITLE

Applications of Fluid and Sediment Mechanics to Basin and Regional Scale Hydrologic and Geomorphic Problems (CR 91—324)

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Problem

Stream systems function as integrated units from the zero-order basins at their heads to their terminations at the sea. Interior adjustments to changes in their headwaters or along their lengths occur in a variety of ways, some of which leave sedimentary deposits that provide important information with regard to the sensitivity of the systems to disturbances of various magnitudes and with respect to the nature of past disturbances. The former type of information is crucial to reliable interpretation of paleoflood deposits and the latter Stream systems function as integrated units from the zero-order basins at their heads to their terminations at the sea. Interior adjustments to changes in their headwaters or along their lengths occur in a variety of ways, some of which leave sedimentary deposits that provide important information with regard to the sensitivity of the systems to disturbances of various magnitudes and with respect to the nature of past disturbances. The former type of information is crucial to reliable interpretation of paleoflood deposits and the latter knowledge is essential for testing hydrologic predictions derived from climate models. In order to interpret fluvial deposits properly, however, an extremely accurate knowledge of stream system mechanics is required.

Objective

The long-term goal of this project is to develop precise, process-based a algorithms for flow, sediment transport, stream channel adjustment, erosion, and deposition in characteristic segments of a wide variety of fluvial systems. These algorithms then can be used to assess local environmental problems along particular types of stream segments, or they can be coupled with each other and with analogous algorithms for hill slope processes in order to produce models for erosion, sediment transport, and deposition on a regional scale and, thereby, to provide a sound, process-based connection between regional hydrology and the salient characteristics of the sedimentary deposits in a wide variety of stream systems.

Approach

Stream systems are far too complex to be understood using empirical data only, but mathematical models that are to be used to provide reliable information from extreme or past events must be predictive in character and they must be devoid of parameters that make calibration of the models necessary. These models must b be thoroughly tested using data from comprehensive

studies of carefully chosen natural systems. The complex morphology of river channels and the intricate topography of hill slopes is generally not well known, and, thus, cannot be treated effectively in a completely deterministic fashion. In contrast, the flow and sediment transport over these surfaces usually can be computed with reasonable accuracy from available fluid mechanical theory if the topography is known. Comprehensive, processes-based flow and sediment transport models for rivers and hill slopes, therefore, must represent the topographic elements in an appropriate stochastic manner while treating the response of the flow to this topography in a proper deterministic fashion. Models that are useful for environmental reconstruction requires the judicious combination of modern fluid mechanical theory with a carefully crafted statistical treatment of the surface over which fluid is moving, so that the dominant nonlinear interactions between the topography and the flow are fully characterized and the evolution of the landscape is accurately represented.

Progress

Owing to the sensitivity of fluvial processes in arid regions to variations in climatic parameters, the importance of water for irrigation and hydroelectric power in the arid West , and the need for models that clearly and conclusively show the environmental effects that do and do not occur from engineering works and natural causes, the Colorado River was chosen as the first system to be examined in detail. As a consequence of uplift of the Colorado Plateau in the late Tertiary, many segments of this system are deeply cut into bedrock, and there is substantial present interest on the part of various agencies of the Department of Interior in improving the current understanding of processes in the incised reaches of this system. Of particular note in this regard are the U.S. Geological Survey-Bureau of Reclamation project in the Black Canyon of the Gunnison and the extremely important, multiagency project in the Marble and Grand Canyons (called GCES-II). Reliable models for the fluvially driven processes in such systems are lacking.

Funding from the U.S. Bureau of Reclamation for U.S. Geological Survey research on the Colorado River between Lake Powell and Lake Mead has made possible a major thrust toward understanding flow, sediment transport, erosion, channel adjustment, and deposition not only in this important segment of the Colorado River, but also in deeply incised systems in general. The Arizona District Office of Water Resources Division, and several National Research Programs and Geological Division Projects, are contributing in a major way to this research effort. The primary role of the project Flow and Sediment Mechanics has been, and continues to be, fluid mechanically based analysis of the main channel flow and sediment transport data and the development of flow, sediment transport, channel adjustment, erosion, and deposition algorithms. These efforts are tightly coupled to comprehensive field data collection programs being superbly carried out by personnel from the Arizona District. Work to date on these topics is summarized in a manuscript entitled "Flow and Sediment Transport in the Colorado River Between Lake Powell and Lake Mead" by J. Dungan Smith and Stephen Wiele. This manuscript is currently undergoing internal review. A local investigation of flow and sediment transport in the neighborhood of the National Canyon gage site also is underway. In this study, velocity and suspended sediment fields measured at the cable by Arizona District personnel are being used to test the predictions of process-based, quasi three-dimensional models derived specifically for this site. Once verified, the suspended sand transport model will be used to produce a sediment rating curve for this site, and this sediment rating curve will be used to provide a

boundary condition for the less sophisticated whole segment sediment transport model. This work will be presented in a manuscript by Schmeeckle, Christiansen, and Smith during the coming year.

Flow in the Colorado River originally was controlled by snow melt in its head-waters; whereas, the sediment input always has been of a more local origin. Currently the major sources of sediment to the Marble and Grand Canyon reaches of the Colorado are the Paria and the Little Colorado Rivers. In both cases, the dominant contribution of material is as suspended load, and in order to provide a more accurate means of determining the amount of sand added to the Colorado below the Glen Canyon Dam, process-based methods for calculating suspended sediment input from these major tributaries are being developed. These models ultimately will be tested against data from the major sand transporting tributaries of the Colorado River and then will be used to calculate sediment inputs from the ungaged tributaries, as well as variations in sediment input with land use and climate from the gaged ones. This work will appear in a manuscript by Topping and Smith.

Another investigation relevant to the Marble and Grand Canyon reaches of the Colorado River involves the mechanics of erosion of bedrock and of particle size reduction by pulverization at the downstream sides of debris fans. Also, it is believed by the project chief that this is the dominant mechanism through which rapid incision occurs in the steep head-waters of tectonically active systems. Finally, work is continuing on the mechanics of debris flows. This research by Schmeeckle and Smith was initiated at the University of Washington, under funding from the Office of Naval Research, in order to understand slumping on silty faces of large deltas, but it also is directly relevant to the development and structure of debris fans in the Grand Canyon and to the rapid movement of lahars down valleys on the flanks of active volcanoes.

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TITLE

Response of Fluvial Systems to Climatic Variability (WR 89—200)

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Problem

Understanding the effects of climatic variability is important to development of water resources, mitigation of flood hazards, and interpretation of geomorphic surfaces. Climatic variability, which is characterized by temporal changes in variability of seasonal climate that spans decades or centuries, may be more important to water-resources evaluations than changes in mean climatic conditions. Changes in variability of climate has a large effect on the probability of occurrence of extreme events, such as floods or droughts. Understanding of climatic variability and its effect on the landscape is of paramount importance for estimation of flood frequency, sediment transport rates, and long- term watershed and channel changes.

Objective

The objective of this project is to define historic climatic variability in the western United States over the past century; to identify specific time periods of statistically stationary precipitation, discharge, flood frequency, and sediment transport; and to assess the net effects of climatic variability on watershed conditions and fluvial systems.

Approach

Historic climatic variability will be assessed through regionalization of temporal climatic signals including temperature and precipitation amounts and intensity. Proxy synthetic records such as tree-ring widths, varved ocean sediments, and non-anthropogenic changes in vegetation will be determined. General circulation of the atmosphere will be examined for long-term changes in precipitation-generating mechanisms that affect the western United States. Generation mechanisms for specific storm types, which include tropical cyclones and winter frontal storms, will be examined for frequency changes in time and space. Paleoflood records will be developed for rivers that are sensitive to climatic variability. Regional flood frequency, streamflow, and precipitation models will be used to assess the effects of variability changes. The stability of desert vegetation will be assessed to determine possible interactions among climate, vegetation change, and storm runoff.

Progress

Research under this project has been focused on development of new dating techniques and reconstruction of environmental changes over the past century on the Colorado Plateau. Dating of alluvial sediments using ^{137}Cs appears promising and potentially as accurate as post-bomb ^{14}C dating. Dendrochronological analyses of catclaw trees (*Acacia greggii*), a common tree in Grand Canyon, yielded cross-dating between this species and conifers. If tree-ring dating of catclaw proves feasible, this species has a large potential for dating ungaged floods and reconstructing the occurrence of floods in isolated areas of the Sonoran Desert. In Grand Canyon, repeat photography has demonstrated a century-long persistence of about 40 species of desert plants, most of which previously were of unknown longevity. Increases in certain species in the photographs indicates that a decrease in frost frequency, which likely occurred around the turn of the century, has affected the Grand Canyon and probably much of the southwestern United States. In addition, the frequency of debris flows in Cataract and Grand Canyons, reconstructed using a combination of alluvial stratigraphy, repeat photography, and dendrochronology, was found to be higher than previously expected. The results, in concert, represent one of the first interdisciplinary efforts at reconstruction of environmental change over a century in an isolated place.

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