

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

WATER RESOURCES DIVISION

TRAINING CATALOG

Compiled by W. R. Hotchkiss and L. A. Foxhoven

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Open-File Report 83-945



Lakewood, Colorado  
1984

UNITED STATES DEPARTMENT OF THE INTERIOR

WILLIAM C. CLARK, Secretary

GEOLOGICAL SURVEY

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## WATER RESOURCES DIVISION TRAINING CATALOG

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Compiled by W. R. Hotchkiss and L. A. Foxhoven

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### INTRODUCTION

#### Purpose and Scope

The National Training Center provides technical and management services necessary for the conduct of U. S. Geological Survey's training programs. These programs include, but are not limited to, specialized training for Survey employees, State Cooperators, and International participants in many facets of hydrology, hydraulics, water-resources investigations as well as computer applications, management seminars, and various special workshops.

The purpose of this catalog is to inform interested personnel about Water Resources Division training courses available through the National Training Center. Survey. The information in this catalog also can assist supervisors and training officers in developing coordinated, efficient training programs and defining career development opportunities for the personnel under their supervision.

The scope of the Water Resources Division part of the National Training Center training program is specialized training in many phases of hydrology and other subjects related to water-resources investigations. The courses described in this catalog are on specialized subjects that are not generally available elsewhere and include the latest developments in applications of ground-water, surface-water, and water-quality hydrologic methods in the field and in the laboratory. The training described herein provides: (1) rapid application of new research results to increase the skills of technical field personnel, and (2) newly recruited personnel with special training skills and methods required in water-resources investigations. These courses will assist personnel in learning, reviewing, and expanding their knowledge of technical operations involved in various phases of hydrology and related subjects, and also will cultivate an overall insight into the broad field of water resources.

#### Training Facilities

Most of the training described herein is presented at the U. S. Geological Survey National Training Center in Lakewood, Colorado (fig. 1). The Training Center is located in Building 53 of the Denver Federal Center, near the intersection of U. S. Highway 6 (Sixth Avenue) and Kipling Street (fig. 2), approximately 8 miles west of downtown Denver. Laboratory and lecture facilities at the National Training Center are air-conditioned, comfortable, and well-equipped. A wide variety of standard audio-visual machines and



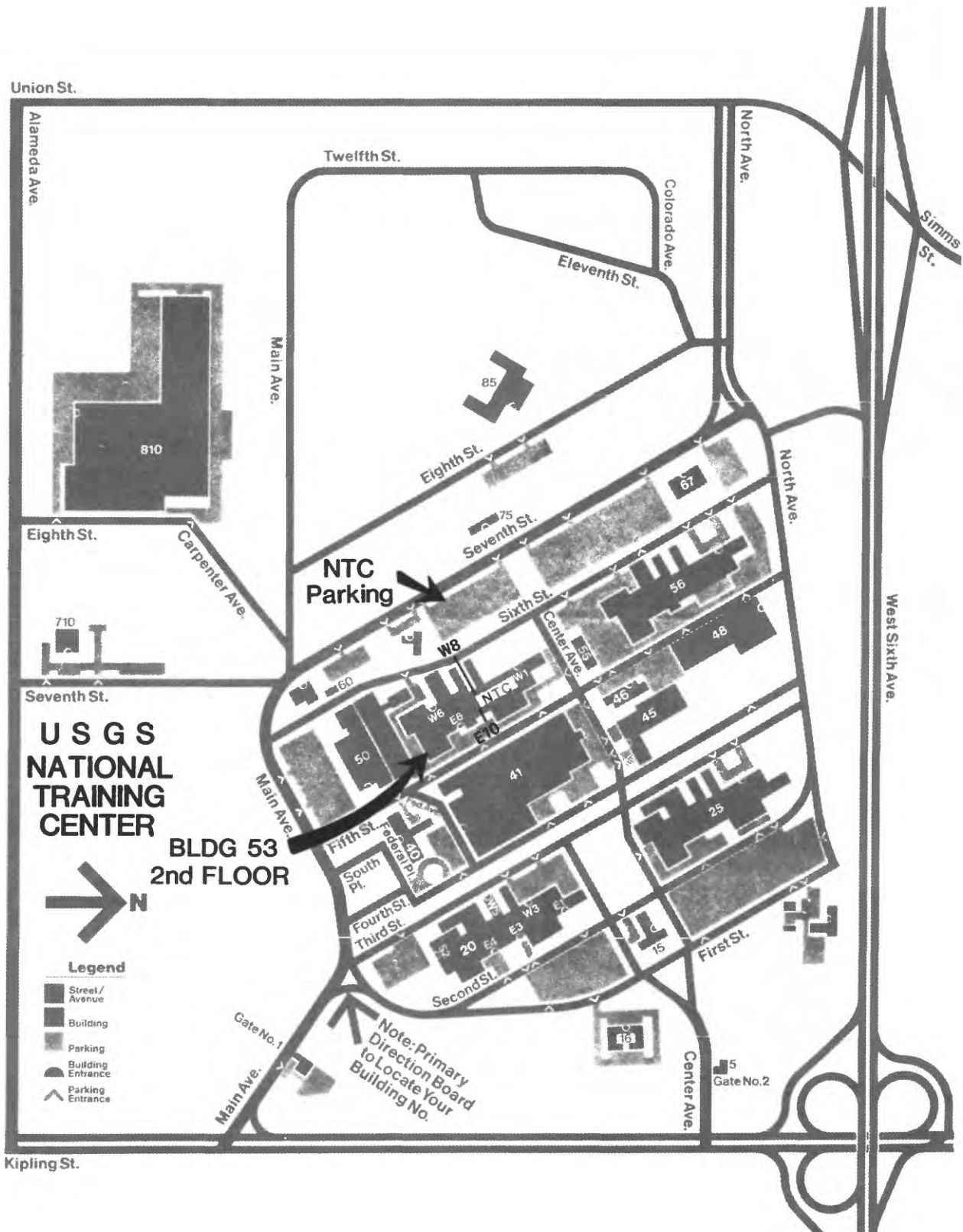


Figure 2.--Location of National Training Center within the Denver Federal Center

support equipment are ready and available for use. In addition, video-recording equipment and closed-circuit television are available in all classrooms, conference rooms, and the laboratory. Television recording equipment is also available for special field sessions. The National Training Center is directly connected to the Colorado District PRIME Minicomputer and can be connected through a port sharing device to the Honeywell computers or the Amdahl computer of the Information Systems Division.

The area around Denver provides the National Training Center with field conditions representative of both plains and mountain environment. Thus, a wide variety of geologic and hydrologic characteristics is available for field trips and field problems.

Some of the training in fluvial-sediment analysis is given at the Water Resources Division's sediment laboratories at Sacramento, California, Harrisburg, Pennsylvania; or Vancouver, Washington. Other specialized training also may be occasionally scheduled at other remote locations.

Some courses given at the National Training Center in the past have been restructured to be given within Regions or Districts where such "regionalized" training is cost-effective and manpower-efficient. A listing and schedule of these courses is available through each of the Regional Training Specialists.

### Training Staff

The training staff of the National Training Center includes the permanent staff of the Center and the Course Coordinators and Instructors of the individual courses offered at the Center. The permanent staff of the Center is on call at all times to consult with instructors, trainees, or training officers to discuss schedules, courses, and/or equipment. The permanent staff includes:

William R. Hotchkiss, Chief of the Center  
Darrell Baldwin, Senior Electronic Technician  
Lucille Foxhoven, Senior Training Technician  
Russel E. Smith, Videographer  
William Bond, Operations manager  
Cynthia Harris, Tape Librarian

The Course Coordinators and Instructors are drawn from Water Resources Division scientists and engineers who are nationally and internationally recognized authorities. These individuals serve as the primary training staff for all training sessions. Experts from other divisions of the Geological Survey, other government agencies, universities, and industries, also serve as lecturers and special consultants.

## DESCRIPTION OF TRAINING COURSES

As a general rule, the training courses are usually structured to include pre-work, lectures (including as many as three evenings per week), workshop problems, course evaluation, and possible field trips. Many courses include pre- and post-testing on the material presented. An alphabetical listing of courses is presented in table 1 for quick reference. Quarterly schedules of courses will be mailed out at regular intervals from the Office of the Assistant Chief Hydrologist for Operations. The schedule (Calendar) also is available through the U. S. Geological Survey ISD Honeywell (Multics) computer system and the WRD Distributed Information System. This information may be accessed by logging in to either Multics system and issuing the command "pr >udd>Ntc>info>ntc.info" or on PRIMENET by "login ntcuser -on dcolkb", password "ntc".

Some courses are presented more than one time during the fiscal year and some courses may be available as self-study or hybrid (home-study, followed by training at the National Training Center) courses. A detailed description of the courses is given in table 2 in the terminal section of this report.

Most of the Training Center courses are designed for Professional personnel, but there are several courses designed for Technicians and for Administrative personnel. Some of the Training Center courses are designed to include visiting foreign hydrologists. In addition, one training course is designed exclusively for International participants.

This catalog describes some courses which may not be scheduled in a given fiscal year. Training officers or interested personnel should request scheduling of desired but unscheduled courses. If enough interest is shown, the desired courses will be scheduled. Requests should be forwarded to the Branch Specialist and the Chief of the National Training Center. Desire for courses not shown in the Catalog also should be expressed to the same individuals.

Special capabilities and experience may be required of personnel attending some of the more advanced or highly specialized training sessions. Please check the Description of Courses carefully for prerequisite requirements. If you have additional questions about pre-enrollment requirements, contact the Course Coordinator or the Chief of the National Training Center.

## ADMISSION TO TRAINING SESSIONS

### Water Resources Division Personnel

Nominations for attendance at each training course will be made by the District or Project Chief to the appropriate Regional Hydrologist before the deadline published on the individual course announcement (or computer Calendar). Each Regional Hydrologist then notifies the Chief, U. S. Geological



Table 1.--*Alphabetical listing of courses*

Title	Page
ADAPTABLE HYDROLOGIC DATA AQUISITION SYSTEM (AHDAS): INSTALLATION AND OPERATION (G0984)-----	19
ADVANCED GEOPHYSICAL LOG ANALYSIS AND FORMATION EVALUATION (G0751)-----	21
ADVANCED HYDRAULIC ANALYSES SEMINAR (G0053)-----	23
ADVANCED MODELING OF GROUND-WATER TRANSPORT (G0071)-----	25
ADVANCED SEMINAR ON WATER QUALITY (G0012)-----	27
ADVANCED WATER-QUALITY CONCEPTS FOR TECHNICIANS (G0022)-----	29
ANALYTICAL METHODS TO DETERMINE AQUIFER PROPERTIES AND TO PREDICT AQUIFER RESPONSE (G0461)-----	31
AQUATIC BIOLOGY: INTERPRETATION AND APPLICATION (G0692)-----	33
AUTOMATED DATA PROCESSING SYSTEM ON THE PRIME (G0634)-----	35
BASIC HYDRAULIC PRINCIPLES (G0043)-----	37
CHEMISTRY FOR GROUND-WATER SOLUTE TRANSPORT MODELS (G0702)-----	39
COMPUTERIZED BIBLIOGRAPHIC AND INFORMATION RETRIEVAL SYSTEMS "CSIN" (G0994)	41
DIS/PRIME ADVANCED "INFO" (G0584)-----	43
DIS/PRIME DATA BASE MANAGEMENT SYSTEM INTERNALS (G0524)-----	45
DIS/PRIME DATA BASE MANAGEMENT SYSTEM PROGRAMMING (G0434)-----	47
DIS/PRIME DISSPLA/TELL-A-GRAF/CUECHART GRAPHICS SYSTEM (G0544)-----	49
DIS/PRIME "INFO" (G0504)-----	51
DIS/PRIME "PORTABLE SAS" USERS (G0514)-----	53
DIS/PRIME PRIME APPLICATIONS PROGRAMMING (G0464)-----	55
DIS/PRIME PRIME USER (G0424)-----	57
DIS/PRIME PRIMOS INTERNALS (G0494)-----	59
DIS/PRIME P-STAT STATISTICAL ANALYSIS SOFTWARE (G0564)-----	61

Table 1.--*Alphabetical listing of courses*--Continued

Title	Page
DIS/PRIME SITE MANAGER (G0444)-----	63
DIS/PRIME TEXT EDITING (G0614)-----	65
EDITORIAL TECHNIQUES (G0244)-----	67
FINITE-ELEMENT MODELING OF GROUND-WATER FLOW (G0971)-----	69
FUNDAMENTALS OF LAKE LIMNOLOGY (G0052)-----	71
FUNDAMENTALS OF STREAM BIOLOGY (G0892)-----	73
GEOCHEMISTRY FOR GROUND-WATER SYSTEMS (G0212)-----	75
GROUND-WATER CONCEPTS (G0761)-----	77
GROUND-WATER FLOW SYSTEMS IN SECONDARY PERMEABILITY TERRANES (G0011)-----	79
GROUND-WATER SITE-INVENTORY WORKSHOP ON THE PRIME (G0644)-----	81
GROUND-WATER/SURFACE-WATER RELATIONSHIPS (G0154)-----	83
ILLUSTRATIONS TECHNIQUES WORKSHOP (G0254)-----	85
INSTRUCTOR TRAINING FOR WATER-QUALITY FIELD TECHNIQUES (G0032)-----	87
INTRODUCTION TO BOREHOLE GEOPHYSICS (G0791)-----	89
INVESTIGATING POINT SOURCE POLLUTION OF GROUND WATER: A SEMINAR FOR WRD MANAGERS (G0981)-----	91
MODELING OF GROUND-WATER FLOW USING FINITE-DIFFERENCE METHODS (G0961)-----	93
MODELING TRANSPORT OF GROUND-WATER SOLUTES (G0801)-----	95
NUMERICAL ANALYSIS FOR ONE-DIMENSIONAL STREAMFLOW MODELS (G0194)-----	97
OPERATION AND MAINTENANCE OF GEOPHYSICAL LOGGING EQUIPMENT (G0061)-----	99
ORGANIC SUBSTANCES IN WATER (G0232)-----	101
ORIENTATION FOR NEW WRD EMPLOYEES (G0894)-----	103
ORIENTATION TO WATER-QUALITY ACTIVITIES IN WRD (G0942)-----	105
PARAMETER ESTIMATION TECHNIQUES FOR GROUND-WATER MODELS (G0931)-----	107

Table 1.--*Alphabetical listing of courses*--Continued

Title	Page
PROJECT PLANNING AND MANAGEMENT (G0064)-----	109
REPORT COLLEAGUE REVIEW (G0414)-----	111
REPORT PLANNING, POLICY, AND REVIEW FOR NEW AUTHORS (G0144)-----	113
REPORT PLANNING POLICY AND MANAGEMENT FOR NEW SUPERVISORS (G0264)-----	115
SAS FOR WATER RESOURCES DATA (G0974)-----	117
SATELLITE DATA-COLLECTION PLATFORM INSTALLATION AND OPERATION (G0174)-----	119
SEDIMENT DATA-COLLECTION TECHNIQUES (G0912)-----	121
SEDIMENT RECORDS COMPUTATION AND INTERPRETATION (G0962)-----	123
SEMINAR FOR NAWDEX ASSISTANCE CENTERS (G0054)-----	125
SEMINAR FOR WATER RESOURCES DIVISION MANAGERS (G0674)-----	127
SEMINAR ON NAWDEX DATA SYSTEMS (G0044)-----	129
STATISTICAL ANALYSIS OF WATER-QUALITY DATA (G0062)-----	131
STATISTICAL APPROACH TO SURFACE-WATER HYDROLOGIC ANALYSIS (G0113)-----	133
SURFACE GEOPHYSICS IN WATER RESOURCES INVESTIGATIONS (G0821)-----	135
SURFACE-WATER HYDRAULIC ANALYSES (G0093)-----	137
SURFACE-WATER QUALITY MODELING (G0072)-----	139
TECHNIQUES OF HYDROLOGIC INVESTIGATIONS FOR INTERNATIONAL PARTICIPANTS (G0000)-----	141
TEST WELL DRILLING CONTRACTS (G0951)-----	143
THEORY AND APPLICATION OF TRACERS IN HYDROLOGIC STUDIES (G0034)-----	145
UNSATURATED FLOW IN POROUS MEDIA (G0841)-----	147
WATER-QUALITY CONCEPTS FOR NEW PROFESSIONALS (G0122)-----	149
WATER-QUALITY DATA-PROCESSING ON THE PRIME (G0992)-----	151
WATERSHED SYSTEMS MODELING (G0083)-----	153

Survey National Training Center of approved nominations for each training course. Admission of personnel from Reston Headquarters is accomplished by having the employee's supervisor nominate the employee as a candidate to the course to the Chief, Manpower Section. For some specialized training, nominations will be made by the Regional Hydrologist to the Chief of the Manpower Section, Water Resources Division, Reston, Virginia.

Applicants will be notified by the Training Center when admission has been approved. Information on housing, local transportation, exact location and time of the training course, required work, potential evening sessions, and other pertinent information will be sent to accepted applicants in advance of their arrival at the Training Center.

#### Other Federal and State Agency Personnel

Admission of personnel from other Federal and/or State agencies is by application to the District Chief of the nearest Water Resources Division office. The District Chief will obtain approval from the appropriate Regional Hydrologist. Admission of personnel from Washington D.C. or National Headquarters agencies is by application through the Chief of the Manpower Section. Reston, Virginia.

Early application for admission is advised since course attendance is always limited. All costs must be paid by the attendee's sponsoring office, for example, housing, transportation, and subsistence; none of these costs will be borne by the Training Center. There will be no tuition cost; however, in a few cases, a fee will be charged to cover extraordinary costs, such as computer time and/or consultant fees.

Applicants will be notified when admission has been approved. Information on housing, local transportation, exact location and time of the training courses, and other pertinent information will be sent to accepted applicants in advance of their arrival at the Training Center.

#### International Participants

Admission of international participants to training courses is by application to the Director, U. S. Geological Survey (Attention: Chief, Office of International Hydrology, Water Resources Division, Mail Stop 470 Reston, Virginia 22092.) Applications usually are transmitted through AID, UN, UNESCO, FAO, or others. International participants will be charged instructional costs. charged instructional costs. In addition, one 8-week course, TECHNIQUES OF HYDROLOGIC INVESTIGATIONS FOR INTERNATIONAL PARTICIPANTS (G0000), is devoted entirely to international students.

## REGISTRATION AND FEE INFORMATION FOR WATER RESOURCES DIVISION PERSONNEL

### Travel Equalization Charge

There is a Travel Equalization Charge for Water Resources Division employees attending the Training Center. The charges have been established for each training course presented at the Training Center based upon the local per-diem rate multiplied by the length of the course (including two travel days), plus average travel costs, plus a fee to defray instructor costs. The instructor fee depends on the number of instructors and on the instructors' home locations. The instructor fee includes a modest stipend for course preparation time if the instructor is not from the Research Program. Research Program instructors include preparation time costs as a part of project expense. In most cases, car pools are organized in advance by Training Center staff so that all trainees will have a ride to and from the Center. Requests for car pool drivers will be made by phone well in advance of the trainees coming to Denver. Car expenses will be repaid to the Districts from training funds. In some special cases, the motel at which the trainees are lodged will provide transportation to and from the Center. The Travel Equalization Charge applies only to Water Resources Division employees attending training as students; accounting procedures for instructors are annually set forth in Water Resources Division training memorandums.

### Billing Procedures

Each student will provide the National Training Center with copy 3 of the completed OF-170 or SF-182 "Request, Authorization, Agreement and Certificate of Training" prior to or on the first day of class. The student's training account number must be typed on the OF-170 or SF-182 in the space marked "Agency Use Only." The Training Center staff will prepare a composite journal voucher to charge the account of each student an amount equal to the Travel Equalization Charge. A copy of this journal voucher will be forwarded to the offices billed. Upon completion of the training session, a travel voucher will be prepared by the student's office covering actual transportation costs and per-diem for the session. These costs should be charged to account number \*-4060-98400 [\* is the last digit of the current fiscal year]. The original copy of the travel voucher is submitted to the Branch of Financial Management, Mail Stop 270, Reston, Virginia 22092, simultaneously a copy must be sent to the Chief of the Manpower Section (Code 4151-3112), Mail Stop 406, Reston, Virginia 22092.

### Preparation of Optional Form OF-170 or Standard Form SF-182

When a District or Project Office is notified by the Training Center that an employee has been selected for training, that office will prepare an OF-170 or SF-182 "Request, Authorization, Agreement and Certification of Training" (5-part form) for each attendee from that office. In completing item 16, considerable thought should be given to the preparation of the statement describing "Benefits to be derived by the Government. Statements like "Career

development" and "to improve present job performance" are not acceptable objectives for Government-sponsored training. All training must be related to the employee's present position or a recognized career ladder position, and must describe clearly the benefit to Government operations, not the benefit to the employee. Career development objectives must meet these basic criteria before training can be authorized. "Course Hours", item 19, is the course duration (in days) multiplied by 8 hours per day; actual course hours may vary because of evening sessions, etc. To properly complete "Indirect Costs", item 22, only an estimated travel and per-diem charge should be included. The Travel Equalization Charge should not be shown. The Appropriation Fund to be charged is \*-4000-98400 [\* is the last digit of the current fiscal year]. Completed forms should be sent to the appropriate Water Resources Division Regional or Headquarters Office for final approval. The approving office will make the following distribution: copies 1 and 2 to the servicing personnel office; copy 3 to the National Training Center; and copy 5 to the originator for employee or office files. The servicing personnel offices and the Training Center no longer require copy 4 of the OF-170 or SF-182 on Water Resources Division training courses.

### Course Evaluation

Students will be required to prepare a brief course end critique at the conclusion of the course and a anonymous narrative critique to be mailed after the student has returned to his or her duty station. Instructions and suggested outlines for preparation of the narrative critique will be given during the course and/or can be found in the Multics information file mentioned above. The critique will be directed to the Chief, National Training Center, U. S. Geological Survey, Mail Stop 414, Box 25046, Lakewood, Colorado 80225. The Training Center will distribute copies as required approximately 60 days following completion of the course.

### COURSES LISTED BY DISCIPLINE

The multidisciplinary and discipline courses are listed by categories to help training officers of students plan a program of courses that will achieve a level of skill in special areas of hydrology. A student may elect to bypass any courses or area of training in which he has already had similar training or has demonstrated proficiency.

The code numbers used in the catalog are the same as those used in the Division's Career Development Forms. This avoids using two numbering systems and enables employees to cross-reference the courses from the Training Catalog with information necessary for their Career Development Forms.

### Multidisciplinary

Courses offered in the Multidisciplinary category include Data Acquisition and Management, WRD Distributed Information System, WRD Orientation and

Management, and Reports Processing. Data Acquisition and Management courses teach input, update, and retrieval of ground-water, daily values, and water-quality data from the WATSTORE system. Most of the Data Acquisition and Processing courses are listed both in this category and in their specific discipline category.

#### I. DATA ACQUISITION AND PROCESSING

Adaptable Hydrologic Data Acquisition Systems (AHDAS): Installation and Operation (G0984)  
Automated Data Processing Systems on the PRIME (G0634)  
Computerized Bibliographic and Information Retrieval Systems  
"CSIN" (G0994)  
SAS for Water Resources Data (G0974)  
Satellite Data-Collection Platform Installation and Operation (G0174)  
Sediment Data-Collection Techniques (G0912)  
Sediment Records Computation and Interpretation (G0962)  
Seminar for NAWDEX Assistance Centers (G0054)  
Seminar on NAWDEX Data Systems (G0044)  
Statistical Analysis of Water-Quality Data (G0062)  
Statistical Approach to Surface-Water Hydrologic Analysis (G0113)  
Water-Quality Data-Processing Workshop on the PRIME (G0992)

#### II. DISTRIBUTED INFORMATION SYSTEM (PRIME)

DIS/PRIME ADVANCED "INFO" (G0584)  
DIS/PRIME Data Base Management System Internals (G0524)  
DIS/PRIME Data Base Management System Programming (G0434)  
DIS/PRIME DISSPLA/TELL-A-GRAF/CUECHART Graphics System (G0544)  
DIS/PRIME "INFO" (G0504)  
DIS/PRIME "PORTABLE SAS" Users (G0514)  
DIS/PRIME PRIME Applications Programming (G0464)  
DIS/PRIME PRIME User (G0424)  
DIS/PRIME PRIMOS Internals (G0494)  
DIS/PRIME P-STAT Statistical Analysis Software (G0564)  
DIS/PRIME Site Manager (G0444)  
DIS/PRIME Text Editing (G0614)

#### III. WRD ORIENTATION AND MANAGEMENT

Orientation for New WRD Employees (G0894)  
Project Planning and Management (G0064)  
Report Planning, Policy, and Management for New Supervisors (G0264)  
Seminar for Water Resources Division Managers (G0674)

#### IV. REPORTS PROCESSING

DIS/PRIME Text Editing (G0614)  
Editorial Techniques (G0244)  
Illustrations Techniques Workshop (G0254)  
Report Colleague Review (G0414)  
Report Planning, Policy, and Review for New Authors (G0144)

## Ground Water

Ground-water courses range from introductory basic concepts and field techniques courses to advanced courses in digital-model simulation of flow and solute transport in aquifer systems. Courses that relate to Ground Water have been divided into subject areas of General, Geophysics, Hydrology, and Modeling.

### I. GENERAL GROUND WATER

Adaptable Hydrologic Data Acquisition Systems (AHDAS):  
Installation and Operation (G0984)  
Automated Data Processing Systems on the PRIME (G0634)  
Computerized Bibliographic and Information Retrieval Systems  
"CSIN" (G0994)  
Ground-Water Site-Inventory Workshop on the PRIME (G0644)  
Seminar for NAWDEX Assistance Centers (G0054)  
Seminar on NAWDEX Data Systems (G0044)  
Test Well Drilling Contracts (G0951)

### II. GROUND-WATER GEOPHYSICS

Advanced Geophysical Log Analysis and Formation Evaluation (G0751)  
Introduction to Borehole Geophysics (G0791)  
Operation and Maintenance of Geophysical Logging Equipment (G0061)  
Surface Geophysics in Water Resources Investigations (G0821)

### III. GROUND-WATER GEOCHEMISTRY

Chemistry for Ground-Water Solute Transport Models (G0702)  
Geochemistry for Ground-Water Systems (G0212)  
Investigating Point Source Pollution of Ground Water: A Seminar for  
WRD Managers (G0981)

### IV. GROUND-WATER HYDROLOGY

Analytical Methods to Determine Aquifer Properties and to Predict  
Aquifer Response (G0461)  
Ground-Water Concepts (G0761)  
Ground-Water Flow Systems in Secondary Permeability Terranes (G0011)  
Ground-Water / Surface-Water Relationships (G0154)  
Unsaturated Flow in Porous Media (G0841)

### V. GROUND-WATER MODELING

Advanced Modeling of Ground-Water Transport (G0071)  
Finite-Element Modeling of Ground-Water Flow (G0971)  
Modeling of Ground-Water Flow using Finite-Difference Methods (G0961)  
Modeling Transport of Ground-Water Solutes (G0801)  
Parameter Estimation Techniques for Ground-Water Models (G0931)



## Surface Water

Surface-water courses cover the principal subjects needed to define the occurrence, distribution, and movement of surface water both under natural conditions and as modified by man. Data collection and the analyses of these data, according to hydrologic principles, are emphasized. Courses that relate to surface water have been divided into subject areas of General, Open Channel Hydraulics, Hydrology, and Streamflow Modeling.

### I. GENERAL SURFACE WATER

Adaptable Hydrologic Data Acquisition System (AHDAS): Installation and Operation (G0984)  
Automated Data Processing Systems on the PRIME (G0634)  
Computerized Bibliographic and Information Retrieval Systems  
"CSIN" (G0994)

### II. SURFACE-WATER OPEN CHANNEL HYDRUALICS

Advanced Hydraulic Analyses Seminar (G0053)  
Basic Hydraulic Principles (G0043)  
Surface-Water Hydraulic Analysis (G0093)

### III. SURFACE-WATER HYDROLOGY

Ground-Water / Surface-Water Relationships (G0154)  
Statistical Approach to Surface-Water Hydrologic Analysis (G0113)

### IV. SURFACE-WATER STREAMFLOW MODELING

Surface-Water Quality Modeling (G0072)  
Numerical Analysis for One-Dimensional Streamflow Models (G0194)  
Theory and Application of Tracers in Hydrologic Studies (G0034)  
Watershed Systems Modeling (G0083)

## Water Quality

The field of water quality encompasses a wide range of subjects and disciplines. Courses offered range from basic concepts and orientation to advanced modeling and interpretation. Several of the courses include field work as well as lectures, and some courses are conducted in locations other than the Training Center. The (G0912) SEDIMENT DATA-COLLECTION TECHNIQUES and (G0052) FUNDAMENTALS OF LAKE LIMNOLOGY courses are given at suitable locations. The (G0892) FUNDAMENTALS OF STREAM BIOLOGY course includes considerable time in the field. Courses that relate to water quality have been divided into General, Chemistry, Aquatic Biology, Sedimentation and Erosion, and Modeling.

### I. GENERAL WATER QUALITY

Adaptable Hydrologic Data Acquisition System (AHDAS): Installation and Operation (G0984)  
Advanced Seminar on Water Quality (G0012)  
Advanced Water-Quality Concepts for Technicians (G0022)  
Automated Data Processing Systems on the PRIME (G0634)  
Computerized Bibliographic and Information Retrieval Systems "CSIN" (G0994)  
Instructor Training for Water-Quality Field Techniques (G0032)  
Orientation to Water-Quality Activities in WRD (G0942)  
Statistical Analysis of Water-Quality Data (G0062)  
Water-Quality Concepts for New Professionals (G0122)  
Water-Quality Data-Processing on the PRIME (G0992)

### II. WATER-QUALITY CHEMISTRY

Geochemistry for Ground-Water Systems (G0212)  
Organic Substances in Water (G0232)

### III. AQUATIC BIOLOGY

Aquatic Biology: Interpretation and Application (G0692)  
Fundamentals of Lake Limnology (G0052)  
Fundamentals of Stream Biology (G0892)

### IV. SEDIMENTATION AND EROSION

Sediment Data-Collection Techniques (G0912)  
Sediment Records Computation and Interpretation (G0962)

### V. WATER QUALITY MODELING

Chemistry for Ground Water Solute Transport Models (G0702)  
Surface-Water Quality Modeling (G0072)  
Modeling Transport of Ground-Water Solutes (G0801)  
Theory and Application of Tracers in Hydrologic Studies (G0034)

## VIDEO TAPE TRAINING COURSES

The National Training Center has a color multicamera television system for recording training courses presented at the Center. A portable color video system is used to record selected field activities. Original video tapes are recorded on 3/4-inch video cassettes. Copies may be requested in any video tape format. The color videotapes are compatible with either color or black and white playback equipment.

The video tapes available from the Training Center are listed in a separate catalog (Video Tape Catalog) available in WRD offices. New tape courses will become available as Course Coordinators edit and release them for distribution. Tape courses may be borrowed on a limited-time loan by written request to this office. Information on the availability of tapes may be obtained by contacting the Training Center Tape Librarian.

## CORRESPONDENCE AND SELF-PACED TRAINING COURSES

The Water Resources Division presently offers three correspondence (denoted by -C) and one self-paced (denoted by -S) training courses which are administered by the National Training Center. These courses are:

FINITE-DIFFERENCE NUMERICAL METHODS IN HYDROLOGY	(G0041-C)
GROUND-WATER CONCEPTS	(G0761-S)
INTRODUCTION TO FORTRAN LANGUAGE	(G0761-C)
PROBABILITY FOR HYDROLOGISTS	(G0333-C)

A description of these courses is found in table 3 in the Terminal Section of this report. Additional information on these courses may be obtained by calling the Training Center or the Manpower Section.

## AUDIO TRAINING COURSES

Each audio tape training course includes audio tape cassettes and text or workbook. Starred courses fulfill the requirement that supervisors take eight hours of supervisor training annually; the double-starred course fulfills 40 hours of supervisory training for new supervisors. To obtain credit for this training, the trainee must apply for training with the SF-182 "Request, Authorization, Agreement and Certification of Training" which should be processed through normal channels (vendor copies should be destroyed). The Trainee should then return a critique of the course, counter-signed by his or her supervisor, to the National Training Center. The Training Center will pass the information on to the proper Regional Training personnel. A brief list of the titles, numbers, and description of the training packages follows:

<u>Title</u>	<u>Number</u>	<u>Course Materials</u>
Executive Seminars in Sound	(A0124)*	8 tapes, 11 page workbook
Executive Writing, Speaking, and Listening Skills	(A0114)*	6 tapes, 88 page workbook
Face-to-Face Human Relations	(A0264)**	7 tapes, 94 page workbook
Guide for Executive Secretaries and Administrative Assistants	(A0184)	6 tapes, 166 page workbook
How to be a Successful Public Speaker	(A0224)	6 tapes, 168 page workbook
How to Run Productive Meetings	(A0104)*	6 tapes, 82 page workbook
Managing by Objectives -MBO-	(A0134)*	6 tapes, 89 page workbook
Managing People	(A0164)*	6 tapes, 49 page workbook
Rapid Reading and Comprehension Skills	(A0244)	6 tapes, 223 page workbook
Reports that Communicate	(A0254)	2 tapes, 98 page workbook
Speed Learning	(A0234)	4 tapes, 290 page workbook, and 5 reading books
Success without Stress	(A0194)	2 tapes, 44 page workbook
Supervisory Effectiveness	(A0144)*	6 tapes, 129 page workbook
The Information Interview	(A0174)	1 tape, 76 page workbook
The Problem Employee Interview	(A0154)*	1 tape, 80 page workbook
Transactional Analysis (TA) is for Everyone	(A0204)	2 tapes, no workbook
Women and More	(A0214)	2 tapes, 22 page workbook

## TERMINAL SECTION

The Terminal Section of this report contains tables 2 and 3. Table 2 contains descriptions of the training courses listed in table 1. Table 3 contains descriptions of three correspondence, and one self-paced course listed in the Correspondence and Self-Paced Training Courses Section of this report.

Table 2.--Description of Courses

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COURSE: (G0984)

TITLE: ADAPTABLE HYDROLOGIC DATA ACQUISITION SYSTEM (AHDAS):  
INSTALLATION AND OPERATION

DESCRIPTION: This 5-day course will train equipment operators in field testing activities for the AHDAS system; the next-generation field hydrologic data acquisition system. The course is transitional in that the initial presentation of the course will consider field testing, but subsequent courses will include complete operators training for the modern electronic system that will replace analog-to-digital recorders, minimonitors, flow through water-quality monitors, and data collection platforms currently operated by the Water Resources Division.

COORDINATOR: R. H. Billings

ATTENDEES: The course is designed for personnel from Districts participating in the AHDAS field test program in FY 1985 and for personnel involved in operational deployments thereafter.

ATTENDANCE: Limited to 16.

Table 2.--Description of Courses--Continued

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COURSE: (G0751)

TITLE: ADVANCED GEOPHYSICAL LOG ANALYSIS AND FORMATION EVALUATION

DESCRIPTION: The primary emphasis of this 5-day course will be placed on the application of basic physical principles and the use of mathematical formulae in the quantitative interpretation of geophysical well logs. A considerable portion of the course will involve the application of these methods to well logs from real aquifers with realistic geohydrologic applications. The following logs will be stressed: resistivity, natural gamma, gamma-gamma, neutron, temperature, acoustic, and spontaneous potential.

COORDINATOR: F. L. Paillet

ATTENDEES: This course is intended for personnel with some experience in the application of borehole geophysics to ground-water problems. Mathematical background should include at least one course in calculus; some familiarity with Fortran programming would be very helpful. Classroom exercises will require the use of a hand-held calculator. Attendees are invited to bring in their own logs or logging problems for classroom evaluation.

ATTENDANCE: Limited to 12.

Table 2.--Description of Courses--Continued

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COURSE: (G0053)

TITLE: ADVANCED HYDRAULIC ANALYSES SEMINAR

DESCRIPTION: This 5-day course is designed to acquaint experienced personnel with new developments in hydraulic analyses. Topics will be selected which appear to be immediately relevant to WRD programs. New computational methods may be introduced. Topics will include problems with indirect methods, one- and two-dimensional flow routing, slope station discharge measurements with flow models, and step-backwater calculations.

Depending on demand, one or more days may be used to discuss topics suggested by the seminar participants. Suggestions from the participants will be requested in advance to allow for the necessary course preparation.

COORDINATOR: V. O. Schneider

ATTENDEES: Personnel who wish to attend the seminar must:

- 1.-Be experienced in surface-water hydraulic analyses; and
- 2.-Have completed the course (G0093) SURFACE-WATER HYDRAULIC ANALYSES or the equivalent.

ATTENDANCE: Limited to 16.

Table 2.--Description of Courses--Continued

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COURSE: (G0071)

TITLE: ADVANCED MODELING OF GROUND-WATER TRANSPORT

DESCRIPTION: The purpose of this 1- to 2-week course (length dependent on specific content presently under development) is to discuss advanced concepts of solute-transport processes and to develop proficiency in simulating three-dimensional, non-isothermal, variable-density ground-water flow and solute transport with chemical reactions. The course will review fundamental concepts, governing equations, relevant numerical methods for solving the equations, and data requirements. Much of the discussions and examples will focus on the use, and limitations of new advanced simulation models.

Typical examples of field problems for which these models could be used include deep-well waste disposal, saltwater encroachment, cyclic storage of freshwater or of hot water, and migration of leachate plumes. Students will be able to obtain a practical working knowledge of the models through "hands-on" use.

Part of the course will be devoted to a seminar format in which each student can contribute to discussions of modeling problems, experiences, and alternative approaches.

COORDINATOR: L. F. Konikow

ATTENDEES: Personnel must have taken the course, (G0801) MODELING TRANSPORT OF GROUND-WATER SOLUTES or have equivalent training and experience with solute-transport modeling, differential equations, numerical methods, and FORTRAN IV computer programming language.

ATTENDANCE: Limited to 20.



Table 2.--Description of Courses--Continued

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COURSE: (G0012)

TITLE: ADVANCED SEMINAR ON WATER QUALITY

DESCRIPTION: This 5-day seminar will present concepts and techniques that are useful in planning and executing interpretive, water-quality oriented, environmental studies. The seminar also is designed to provide the attendees with up-to-date information on Division activities in water-quality, as well as state of the science and progress in new water-quality techniques. The theme of the seminar will be concerned with Water Resources Division studies and progress in the movement and fate of hazardous substances, analytical methods development, quality assurance, acid-rain investigations, interpretive studies of national monitoring network data, ground-water contamination and the Division's technology-transfer activities.

COORDINATOR: W. L. Bradford

ATTENDEES: This course is open to District water-quality specialists and all water-quality professionals who are engaged (or will be in the near future) in water-quality studies. District water-quality specialists are encouraged to attend the seminar at least once every 3 years.

ATTENDANCE: Limited to 40.

Table 2.--Description of Courses--Continued

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COURSE: (G0022)

TITLE: ADVANCED WATER-QUALITY CONCEPTS FOR TECHNICIANS

DESCRIPTION: This 5-day course is designed to address the theoretical concepts of water-quality data collection with emphasis on explaining the reasons of water-quality operations, interpretation and dissemination of the results, and proper methodology. Some topics of discussion are:

- 1.-Sediment movement in streams;
- 2.-Inorganic, organic, and biological properties of water quality;
- 3.-Design and operation of field data programs; and
- 4.-Concepts of representative sampling.

The technically oriented topics will be presented both as lectures and workshop seminars.

COORDINATOR: M. O. Fretwell

ATTENDEES: This is an advanced course for technicians. Attendees must have completed either (G0042) WATER QUALITY FIELD TECHNIQUES or (G0912) SEDIMENT DATA COLLECTION TECHNIQUES or have a minimum of 3 years of water-quality field activities experience.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0461)

TITLE: ANALYTICAL METHODS TO DETERMINE AQUIFER PROPERTIES AND TO PREDICT AQUIFER RESPONSE

DESCRIPTION: This 5-day course is designed to acquaint or refresh field personnel with current analytical methods used in the ground-water discipline. Method of analyzing bounded, leaky, anisotropic, layered, and confined aquifers will be described by staff specialists, and exercises will be worked by the class participants. Special problems in aquifer-test analysis and prediction of aquifer response will be discussed. Analysis of observation-well data near streams, and of stream-aquifer interactions will be stressed.

COORDINATOR: E. P. Weeks.

ATTENDEES: Personnel must:

- 1.-Have a basic understanding of aquifer mechanics and aquifer-test analysis;
- 2.-Have a need for additional knowledge on analytical methods or aquifer analysis; and
- 3.-Should be familiar with the use of the Theis equation for analyzing aquifer tests and predicting drawdowns.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0692)

TITLE: AQUATIC BIOLOGY: INTERPRETATION AND APPLICATION

DESCRIPTION: The purpose of this 5-day course is to demonstrate the meaning, use, and limitations of aquatic biological data obtained in hydrological studies. Emphasis will be placed on the practical application of the data. All topics will be illustrated with examples of how investigators have used aquatic biological information to understand the environment for solving some problem.

COORDINATOR: G. E. Mallard

ATTENDEES: Personnel must be involved in the interpretation and application of aquatic biological data and must have attended at least one of the two courses, (G0052) WORKSHOP ON LAKE LIMNOLOGY, or (G0892) WORKSHOP ON STREAM BIOLOGY (listed previously as (G0052) FUNDAMENTALS OF LAKE LIMNOLOGY and (G0892) FUNDAMENTALS OF STREAM BIOLOGY or equivalent (for example, an academic degree in biology).

ATTENDANCE: Limited to 30.

Table 2.--Description of Courses--Continued

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COURSE: (G0634)

TITLE: AUTOMATED DATA PROCESSING SYSTEM ON THE PRIME

DESCRIPTION: The 5-day workshop will include discussion and sample problems using the ADR system on the PRIME computer. This will include entry of data into the Station Header File, Daily Values File, Unit Values File, and the Peak Flow File. The course will include explanation of the use of the system in processing data from streamflow, ground-water levels, digital-monitor data, deflection-meter data and rate-of-change of stage data as well as retrieval of basic data from the file. The use of interactive terminals will be included in the course.

COORDINATOR: N. G. Stuthmann

ATTENDEES: The material to be presented at the workshop is directed to those individuals who are actively involved in processing and storing data in the WATSTORE files on the PRIME computer.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0043)

TITLE: BASIC HYDRAULIC PRINCIPLES

DESCRIPTION: This 5-day course combines lectures and class problems in basic open-channel flow problems. With the addition of the (G0043) BASIC HYDRAULIC PRINCIPLES training course, a system of prerequisites can be established that should better prepare participants for the more advanced courses. The following prerequisite course system will be adhered to concerning hydraulic courses taught by the Surface Water Branch:

Participants for the (G0093) SURFACE-WATER HYDRAULIC ANALYSES course must have attended the course (G0043) BASIC HYDRAULIC PRINCIPLES or have completed college-level courses in hydraulics or fluid mechanics.

COORDINATOR: H. E. Jobson

ATTENDEES: Hydrologists who have little or no background in the principles of basic hydraulics and fluid mechanics or who need a review of these basic concepts may attend. This course, or its equivalent, is a prerequisite to (G0093) SURFACE-WATER HYDRAULIC ANALYSES.

ATTENDANCE: Limited to 16.

Table 2.--*Description of Courses*--Continued

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COURSE:	(G0702)
TITLE:	CHEMISTRY FOR GROUND-WATER SOLUTE TRANSPORT MODELS
DESCRIPTION:	<p>This 2-week course, intended primarily for chemists and geochemists, provides lectures and workshop sessions on quantitative interpretations of geochemical processes in ground-water systems and how these processes are incorporated into solute transport models. It is anticipated that graduates of this course will cooperate with graduates of course (G0801) MODELING TRANSPORT OF GROUND-WATER SOLUTES in solving solute transport and other geochemical problems. Topics to be presented include:</p> <ol style="list-style-type: none"> <li>1.-Fundamentals and concepts of solution chemistry;</li> <li>2.-Solution-mineral reactions;</li> <li>3.-Equilibrium concepts;</li> <li>4.-Kinetics of solution-mineral reactions;</li> <li>5.-Surface chemistry;</li> <li>6.-Organic geochemistry;</li> <li>7.-Microbiologic processes;</li> <li>8.-Water Resources Division mineral-equilibrium models;</li> <li>9.-Conservative and nonconservative models;</li> <li>10.-Chemical parameter evaluation procedures; and</li> <li>11.-Finite-difference methods making it possible to utilize solute transport equations for modeling of conservative and reacting solutes in ground-water systems.</li> </ol>
COORDINATOR:	Y. K. Kharaka
ATTENDEES:	<p>Personnel must:</p> <ol style="list-style-type: none"> <li>1.-Be experienced in the analysis of chemical and geochemical data (equivalent to first-year undergraduate university level chemistry);</li> <li>2.-Be familiar with the concepts of ground-water flow;</li> </ol>

3.-Have programming experience or obtain appropriate programming training prior to the course. (Be able to assemble a computer program in at least one computer language.);

4.-Be familiar with terminals and be able to interactively communicate with mini or mainframe computers; and

5.-Complete reading assignments and return completed problem sets to the course coordinator prior to the beginning of the course.

Proficiency in highschool level algebra is sufficient for the course.

ATTENDANCE: Limited to 20.



Table 2.--Description of Courses--Continued

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COURSE:	(G0994)
TITLE:	COMPUTERIZED BIBLIOGRAPHIC AND INFORMATION RETRIEVAL SYSTEMS "CSIN"
DESCRIPTION:	<p>This 3-day course provides an introduction to use of the computer system CSIN; an interface that provides access to six major information-retrieval systems containing more than 400 bibliographic data bases. CSIN is a language-management system that allows users to search commercially available bibliographic systems without knowledge of the command languages or protocols of these systems.</p> <p>The course consists of lectures and lab exercises using CSIN. Attendees will be given an overview of the basic elements of on-line bibliographic searching followed by a comprehensive introduction to the CSIN. Attendees will learn to:</p> <ol style="list-style-type: none"><li>1.-Connect to CSIN via PRIMENET;</li><li>2.-Create, edit, and review files and query lists (such as lists of descriptors and keywords); and</li><li>3.-Conduct searches using script mode (automatic searching feature), direct mode (non-automatic searching feature), and enhanced direct mode (combination searching feature).</li></ol>
COORDINATOR:	D. A. Wiltshire
ATTENDEES:	This training is designed for researchers and project staff who will need literature reviews or chemical data for hydrologic investigations, research projects, and bibliographic references for reports. Basic familiarity with PRIME system in a user capacity is essential; knowledge of online bibliographic searching is desirable but not required.
ATTENDANCE:	Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0584)

TITLE: DIS/PRIME ADVANCED "INFO"

DESCRIPTION: This 3-day course includes advanced instruction in the use of INFO data file management, data forms entry, retrievals, data manipulation, relational concepts, and report generation. Specifically, advanced techniques for using and programming in INFO will be studied.

COORDINATOR: HENCO Personnel

ATTENDEES: DIS/PRIME "INFO" systems staff, regional computer specialists, and WRD site managers. Experience with INFO or completion of the introductory (G0504) DIS/PRIME "INFO" course is prerequisite to this course.

ATTENDANCE: Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0524)

TITLE: DIS/PRIME DATA BASE MANAGEMENT SYSTEM INTERNALS

DESCRIPTION: This 5-day course will be taught in Reston and will introduce students to the design and description of the PRIME Data Base Management System (DBMS). The students will be able to define schemas, subschemas, and set up a data base using DBMS.

COORDINATOR: PRIME Personnel

ATTENDEES: This course is for WRD personnel who will be involved in designing data bases under PRIME DBMS. Attendees should have a general understanding of the internals of at least one data base management system.

ATTENDANCE: Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0434)

TITLE: DIS/PRIME DATA BASE MANAGEMENT SYSTEM PROGRAMMING

DESCRIPTION: This is a 2-week course:

Week 1 concentrates on techniques used in creating program libraries from Fortran, Cobol, PL/1 and assembler programs and subprograms on the PRIME computer systems. It combines the subject material from the PRIME "Application Programmer" and "Project Leader" course. Linking, loading, creating and updating of libraries are presented.

Week 2 teaches Fortran and Cobol program language interfaces to PRIME's DBMS software. It is intended for programmers who will be designing and maintaining DBMS application programs-not for the user of DBMS software. Topics related to use of the DBMS retrieval language are not covered.

COORDINATOR: PRIME Personnel

ATTENDEES: Programers and data base administrators who intend to write Fortran, Cobol, PL/1 and assembler programs and libraries associated with PRIME DBMS applications. Familiarity with PRIME computer systems (or attendance at a (G0424) PRIME USER course) is a prerequisite.

ATTENDANCE: Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0544)

TITLE: DIS/PRIME DISSPLA/TELL-A-GRAF/CUECHART GRAPHICS SYSTEM

DESCRIPTION: This 5-day course provides introductory and advanced concepts in the use of DISSPLA and TELL-A-GRAF graphics software products on the PRIME computer. Students will learn how to write programs using calls to DISSPLA subroutines. The major types of subroutines will be introduced; basic graphics setup, x-y plots, bar and pie graphs, maps, and 3-dimensional plots. Students will also learn how to use the stand-alone graphics package, TELL-A-GRAF. The commands used to draw pie, bar, and x-y plots without the need to write a program will be introduced. The various methods of accessing a user's data will be presented. Students will run sample problems on the computer.

DISSPLA is presented over a 2-day session. The first day provides an introduction to the features and use of DISSPLA from F77 programs. The second day presents more advanced features and uses of DISSPLA procedures. Similarly, TELL-A-GRAF is presented for two days, moving from introductory to advanced. CUECHART, the conversational front end to TELL-A-GRAF, is presented during one 1/2-day session. File Connection, the data-set manipulation package, is presented during the afternoon of the CUECHART session.

COORDINATOR: ISSCO Personnel

ATTENDEES: This course is intended for those who have little or no prior experience using DISSPLA, TELL-A-GRAF, or CUECHART on any computer. (It is specifically not for current users of these products who want to learn the differences between the use of these software packages on the PRIME and on other computers.) Experience in writing programs on PRIME computers using F77, PL/1, or BASIC compilers is essential.

ATTENDANCE: Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0504)

TITLE: DIS/PRIME "INFO"

DESCRIPTION: The first two days of this 3-day course includes instruction in the use of INFO data file management, data forms entry, retrievals, data manipulation, relational concepts, and report generation. The third day covers INFO-CALL (linking INFO to high level languages) and INFO-FLOW (programming documentation aid).

COORDINATOR: HENCO Personnel

ATTENDEES: WRD computer specialists; project personnel; GW, QW, and SW data personnel; and administrative staff.

ATTENDANCE: Limited to 15. (Five additional attendees may audit each session.)

Table 2.--Description of Courses--Continued

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COURSE: (G0514)

TITLE: DIS/PRIME "PORTABLE SAS" USERS

DESCRIPTION: This 5-day course is an introduction to the use of the Statistical Analysis System (SAS) on the PRIME computer. Many of the SAS procedures used for the analysis of data are introduced, including SAS/GRAF. Examples of using SAS for the analysis of water resources data are presented. Students will run sample problems on the computer.

COORDINATOR: WRD Personnel

ATTENDEES: This course is intended for personnel who have little or no prior knowledge of SAS on any system. (It is specifically not for current SAS users who want to learn the differences between SAS on a PRIME and SAS on other computers.) An elementary knowledge of how to use (login, edit, files, and run programs) a PRIME computer is required.

ATTENDANCE: Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0464)

TITLE: DIS/PRIME PRIME APPLICATIONS PROGRAMMING

DESCRIPTION: This 5-day course concentrates on techniques used in creating program libraries from Fortran, Cobol, PL/1, and assembler programs, and subprograms on the PRIME computer systems. It combines the subject material from the PRIME "Application Programmer" and "Project Leader" course. Linking, loading, creating and updating of libraries are presented.

COORDINATOR: PRIME Personnel

ATTENDEES: Programmers who intend to write Fortran, Cobol, PL/1, and assembler programs and libraries. Familiarity with PRIME computer systems (or attendance at a (G0424) PRIME USER course is a prerequisite.

ATTENDANCE: Limited to 15.



Table 2.--Description of Courses--Continued

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COURSE: (G0424)

TITLE: DIS/PRIME PRIME USER

DESCRIPTION: This 2-day course provides an introduction to PRIME computers, including file structures, logging into the system, use of directories, file security, terminal operation, access to the DIS network, use of the editors and the concepts of PRIMOS commands. A third day can be scheduled depending on the needs and interests of the attendees. Presentation of some advanced programming-related concepts such as the use and modification of program libraries could be included.

COORDINATOR: WRD Personnel

ATTENDEES: Individuals who intend to use the DIS/PRIME computers may attend. While some attendees will be novice computers users, most will be those with computer experience who are actively involved with projects where intensive use of the DIS/PRIME computers is imminent. This course (or equivalent experience) is a prerequisite to acceptance in the DIS/PRIME Data Base Management Systems Programing course.

ATTENDANCE: Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0494)

TITLE: DIS/PRIME PRIMOS INTERNALS

DESCRIPTION: This 4-day course will be taught in Reston and will provide insight into the relationships and functions of the programs that comprise PRIMOS operating system and how they relate to PRIME hardware.

COORDINATOR: PRIME Personnel

ATTENDEES: This course is designed for DIS Systems Staff, some projects, and some Districts. Attendees should have a good understanding of PRIME systems. (G0444) DIS/PRIME SITE MANAGER is a prerequisite to this course. In addition, some knowledge of assembler language and the internal hardware and software structures of computers is recommended.

ATTENDANCE: Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0564)

TITLE: DIS/PRIME P-STAT STATISTICAL ANALYSIS SOFTWARE

DESCRIPTION: This 3-day course introduces the use of the statistical, file-handling, and report generation features of P-STAT. Students will learn to build or transfer data sets, process them against the statistical procedures in P-STAT, and to display the results of these analyses on the terminal or printer.

COORDINATOR: P-STAT, Inc. Personnel

ATTENDEES: This course is for WRD computer specialists and project personnel who intend to use P-STAT interactive statistical analysis techniques or to teach others how to do so. This is not a seminar on the theory or meaning of statistics, but a presentation on how to use P-STAT software for statistical analysis.

ATTENDANCE: Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0444)

TITLE: DIS/PRIME SITE MANAGER

DESCRIPTION: This is a 2-week course:

Week 1 concentrates on an introduction to PRIME computers, including file structures, logging into the system, use of directories, file security, various editors, Command Program Language, PRIMOS, PRIMOS-II and, techniques to be used in the daily operations of the system, including bootstrapping, system backups, operator console commands and X.25 network operations. The (G0424) PRIME USER and PRIME Operator courses are combined into week 1.

Week 2 is the PRIME SYSTEM ADMINISTRATOR course. Topics include configuration of the system (for bootstrapping), user-profile definition, system security, disk resource allocation, network configuration, system performance/tuning, and system error recovery.

This course is intended to instruct a person on every aspect of importance to the DIS/PRIME system administration. The attendee is expected to instruct people at his/her local site on appropriate course materials.

COORDINATOR: PRIME Personnel

ATTENDEES: Individuals who are designated as the site manager for a DIS/PRIME computer system. The site manager is one who is responsible for the technical aspects for planning for site preparation, ordering the specific configuration from the DIS contract, installing the system, administering the system for the local user community and the connection to the DIS network and resolving user/system-resource conflict with DIS management and PRIME support personnel.

ATTENDANCE: Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0614)

TITLE: DIS/PRIME TEXT EDITING

DESCRIPTION: This 3-day course introduces the use of the text editors available on the PRIME system: EDITOR, EMACS, and the proprietary word processing package. The student will learn which editor to use for different types of applications and the strengths and weaknesses of each. Hands-on laboratories will concentrate on one of the text editors, using the TAB terminal.

COORDINATOR: A. W. Harbaugh

ATTENDEES: This course is designed for DIS/PRIME computer users, specifically project, computer, and administrative personnel who must perform text file creation and update procedures. The trainee must know how to log into and use the PRIME computer from a TAB or equivalent terminal. This course is not intended as a primer on the use of PRIME systems.

ATTENDANCE: Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0244)

TITLE: EDITORIAL TECHNIQUES

DESCRIPTION: This 5-day course provides instruction and class problems in manuscript preparation and editing as practiced by the Water Resources Division. Emphasis will be placed on the following publications; Suggestions to Authors, WRD Publications Guide, GPO Style Manual, and on report policy memorandums.

The course agenda will include:

- 1.-Report planning;
- 2.-Editing processes;
- 3.-Editorial references;
- 4.-Punctuation;
- 5.-Sentence editing;
- 6.-Editing reports and memorandums;
- 7.-Report policy; and
- 8.-Report training exercises.

COORDINATOR: J. E. Moore

ATTENDEES: Editorial clerks and others who are or will be assigned to the editing of technical reports.

ATTENDANCE: Limited to 16.

Table 2.--Description of Courses--Continued

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COURSE: (G0971)

TITLE: FINITE-ELEMENT MODELING OF GROUND-WATER FLOW

DESCRIPTION: This 2-week course includes explanation of the theory and application of a digital ground-water flow model employing finite-element discretization in time, two-dimensional space, and Galerkin's methods of weighted residuals. Triangular elements with linear basis functions subdivide the aquifer region to be modeled, providing a more accurate representation of hydrologic boundaries and better utilization of spatial discretization than is presently available with finite-difference techniques. Rivers and line discontinuities such as faults can be located accurately with the finite-element mesh and are represented as one-dimensional elements. The model has radial (r-z)-coordinate and cross-section capability and is designed to simulate two-dimensional flow in a nonhomogeneous anisotropic aquifer where principle directions of anisotropy vary over the model region. Areal flow can be simulated in either a confined or an unconfined aquifer. Sources and sinks include constant flux and head dependent flux boundaries, point and areally distributed fluxes (wells, springs, drains, ET, recharge), and steady and transient leakage from a source layer.

Program structure utilizes a state-of-the-art "modular" design whereby hydrologic features can be added, deleted, or modified without affecting computations in unrelated parts of the computer code. The program is also designed to efficiently use and reuse computer storage. The elements of the program design will also be explained in the subject training course.

COORDINATOR: L. J. Torak

ATTENDEES: Those individuals who have experience in finite-difference modeling, have taken (G0961) MODELING OF GROUND-WATER FLOW USING FINITE-DIFFERENCE METHODS, or have taken (G0911) MODELING OF GROUND-WATER FLOW when it was given in the past or have equivalent training or experience.

ATTENDANCE: Limited to 20.

Table 2.--Description of Courses--Continued

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COURSE: (G0052)

TITLE: FUNDAMENTALS OF LAKE LIMNOLOGY

DESCRIPTION: This 2-week workshop emphasizes the practical conduct of limnological studies with special emphasis on the development of competence in lake techniques. Field endeavors will include the study of physical and chemical lake dynamics and of biological productivity. Attendees will be instructed on the proper design of limnological investigations.

COORDINATOR: G. E. Mallard

ATTENDEES: Personnel who are actively engaged or will be engaged in lake studies.

ATTENDANCE: Limited to 20.



Table 2.--Description of Courses--Continued

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COURSE: (G0892)

TITLE: FUNDAMENTALS OF STREAM BIOLOGY

DESCRIPTION: This 5-day workshop will emphasize the design and conduct of biological studies of stream environments. Field and laboratory activities will include the collection and processing of biological samples. Lectures will cover the theoretical aspects of stream biology with emphasis on indicator organisms and community structure.

COORDINATOR: G. E. Mallard

ATTENDEES: Personnel who are actively engaged or will be engaged in biological studies on streams.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0212)

TITLE: GEOCHEMISTRY FOR GROUND-WATER SYSTEMS

DESCRIPTION: This 10-day course includes quantitative interpretation of hydrochemical data for ground water that will be discussed in terms of principal reaction mechanisms and their geologic environment. Consideration is given to basic solution theory, equilibrium thermodynamics, mineral-water interactions, mass balances, and the elements of mass transfer. Examples of computational analysis, relevant programs (such as WATEQF, BALANCE, and PHREEQE), and applications to field problems are included.

COORDINATOR: L. N. Plummer

ATTENDEES: The course is limited to participants who are currently involved in interpreting field geochemical data. Personnel must have basic familiarity with chemical analyses of natural waters and a general background in chemistry equivalent to completion of one year of undergraduate university training. Familiarity with aspects of geology, hydrology, and mineralogy is assumed.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0761)

TITLE: GROUND-WATER CONCEPTS

DESCRIPTION: This 9-day course stresses the basic physical and mathematical concepts that are requisite to the effective modeling of ground-water systems. During the first week, emphasis is placed on a review of fundamentals; Darcy's Law, ground-water storage, the differential equations of flow, boundary conditions, superposition, the nature of coefficients, and analytical solutions. Finite-difference concepts are developed in detail by reference to electrical analogy and the governing equations. Throughout this course attendees will reinforce theoretical concepts with laboratory exercises using electrical models, with finite-difference simulations, carried out both by hand calculation and by digital computer. The second week emphasizes applications to typical ground-water problems; the characteristics of various boundary conditions, coordinate systems and model types are evaluated. Actual flow systems will be discussed, and the group will "conceptualize" the systems and evaluate the fundamental assumptions and decisions that lead to successful modeling.

COORDINATOR: O. L. Franke

ATTENDEES: Personnel who enroll in this course are expected to enroll subsequently in the correspondence course (G0041) FINITE-DIFFERENCE NUMERICAL METHODS IN HYDROLOGY unless they have demonstrated an equivalent level of achievement. Attendees must have ground-water project experience.

ATTENDANCE: Limited to 20.

Table 2.--Description of Courses--Continued

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COURSE:	(G0011)
TITLE:	GROUND-WATER FLOW SYSTEMS IN SECONDARY PERMEABILITY TERRANES
DESCRIPTION:	<p>This 5-day course includes analysis of ground-water flow in fractured rock, in limestone solution channels and in jointed igneous or metamorphic rocks, commonly based on approximations derived from the study of porous media. Although other models (analytical and numerical) that account for secondary permeability and porosity (or discrete fractures) exist, these have received little attention in ground-water investigations.</p> <p>This 5-day course is designed to:</p> <ol style="list-style-type: none"><li>1.-Introduce geologic factors controlling secondary permeability;</li><li>2.-Consider utility and limitations of applying porous media models in secondary permeability terranes;</li><li>3.-Introduce alternative modeling concepts (such as, double porosity and discrete fractures); and</li><li>4.-Provide a forum for exchange of ideas from personnel conducting theoretical and practical studies in secondary permeability terranes.</li></ol>
COORDINATOR:	R. J. Sun
ATTENDEES:	Personnel with interest in secondary permeability terrane and familiarity with ground-water flow equations for porous media may attend. Experience with analytical methods or with numerical modeling is required.
ATTENDANCE:	Limited to 20.

Table 2.--Description of Courses--Continued

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COURSE: (G0644)

TITLE: GROUND-WATER SITE-INVENTORY WORKSHOP ON THE PRIME

DESCRIPTION: This 5-day course is the basic Ground-Water Site-Inventory (GWSI) system for use on the PRIME computer. The workshop provides training for preparation, editing, inputting, and retrieval of GWSI data. Problems will be given for each phase of the course including data coding, data editing, data input, and data retrieval using user-friendly software and application programs.

COORDINATOR: C. O. Morgan

ATTENDEES: This course is designed for personnel requiring a basic understanding of the preparation, editing, inputting, and retrieval of GWSI data. Basic understanding of the use of the PRIME computer is necessary. Interactive terminals will be used during the course.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0154)

TITLE: GROUND-WATER / SURFACE-WATER RELATIONSHIPS

DESCRIPTION: This 5-day course has two goals:

- 1.-To provide practical methods of using streamflow data to obtain information on ground-water resources; and, conversely, using ground-water information to better evaluate surface-water resources. The methods include statistical analysis of streamflow data hydrograph separation, and analytical ground-water hydrology; and
- 2.-To make participants aware of current research in the interrelationships of ground water and surface water.

COORDINATOR: T. C. Winter

ATTENDEES: Experienced personnel of the Water Resources Division and its cooperators may attend.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0254)

TITLE: ILLUSTRATIONS TECHNIQUES WORKSHOP

DESCRIPTION: The purpose of this 5-day course is to provide new authors and illustrators with information on illustration planning, policy, and preparation. The agenda for this course will include:

- 1.-The various techniques for designing, drafting, and laying out illustrations for a technical report;
- 2.-Descriptions and sources of drafting equipment and supplies, and their proper use; and
- 3.-Class exercises in designing and preparing illustrations.

COORDINATOR: J. E. Moore

ATTENDEES: Professional employees who plan to prepare illustrations for technical reports.

ATTENDANCE: Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0032)

TITLE: INSTRUCTOR TRAINING FOR WATER-QUALITY FIELD TECHNIQUES

DESCRIPTION: The Water Quality Field Techniques course is now taught at Region and District level because the demand for the course could not be met at the National Training Center with a reasonable number of courses. To ensure that similar techniques are taught at all courses and to lessen the burden of preparation on potential instructors, this course will provide new instructors with a discussion of the material to be covered in District and Region training courses as well as copies of the course syllabus, handout material, and visual aids. In addition, instructors will discuss how to use the material provided and will suggest ways to teach the material and to organize the new training courses.

COORDINATOR: J. C. Briggs

ATTENDEES: This course is intended for professionals and senior technicians who have a strong water-quality background and who will be serving as instructors at a water-quality field techniques course within the next year.

ATTENDANCE: Limited to 24.



Table 2.--Description of Courses--Continued

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COURSE: (G0791)

TITLE: INTRODUCTION TO BOREHOLE GEOPHYSICS

DESCRIPTION: The emphasis of this 5-day course will be on the basic principles of well logging equipment utilized within the Water Resources Division. The operation, calibration, and standardization of logging equipment will be discussed. The interpretation of the following kinds of logs will be stressed: Resistance, Resistivity, Spontaneous Potential, Caliper, Natural Gamma, Gamma-gamma, Neutron, Acoustic Velocity, Temperature, Fluid Conductivity, and Flowmeter.

COORDINATOR: F. L. Paillet

ATTENDEES: This course is intended for personnel with some background or experience in the application of borehole geophysics to ground-water problems or those who will soon be engaged in this field. Previous training in earth sciences and ground-water hydrology is essential. Attendees are invited to bring their own logs or logging problems for discussion in class.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0981)

TITLE: INVESTIGATING POINT SOURCE POLLUTION OF GROUND WATER: A SEMINAR FOR WRD MANAGERS

DESCRIPTION: The objective of this 5-day seminar is to provide an overview of the technology available for investigating point source pollution of ground water. The primary emphasis will be directed to hazardous organic compounds and metals. The seminar will include presentations and discussions about:

- 1.-Technology currently available;
- 2.-Ongoing research that may increase our descriptive or predictive capability in the near future; and
- 3.-Existing capabilities that can be provided to a cooperator for management purposes in a reasonable time frame.

COORDINATOR: J. D. Bredehoeft

ATTENDEES: This course is designed for District Chiefs, Project-Section Chiefs, and District Water-Quality Specialists. Because of space limitations, only one of the above-mentioned persons from each District may attend.

ATTENDANCE: Limited to 35.

Table 2.--*Description of Courses*--Continued

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COURSE: (G0961)

TITLE: MODELING OF GROUND-WATER FLOW USING FINITE-DIFFERENCE METHODS

DESCRIPTION: This is a hybrid course consisting of about 100 to 120 hours of home-study followed by 9 days of intensive study at the National Training Center. The trainees will be given about 4 months to complete the home-study phase. The purpose of this course is to introduce participants to the theory of finite-difference modeling and to give the participants experience in using the new U. S. Geological Survey model.

This course replaces:

1.-The 2-week course (G0911) MODELING OF GROUND-WATER FLOW that introduced finite-difference methods and gave hands-on experience with a two-dimensional finite-difference ground-water flow model (Trescott and others); and

2.-The first week of the 2-week course (G0681) ADVANCED MODELING OF GROUND-WATER FLOW that introduced the three-dimensional finite-difference ground-water flow model (Trescott and Larson).

The self-study phase of the course will introduce:

1.-Darcy's law, conservation of mass, and examples of how these properties are combined to develop equations that describe some simple flow problems; and

2.-Mathematical preliminaries: derivatives, Taylor's series, integration, simultaneous linear equations, matrix properties, elementary matrix operations, and direct and iterative methods for solving simultaneous linear equations.

The self-study phase of the course combines reading assignments and problems on each of these topics. It enables all of the participants to reach a comparable level of knowledge prior to the classroom phase.

The classroom session will cover:

1.-Structure and input requirements of the U. S. Geological Survey finite-difference model;

2.-Practical problems involved in applying ground-water models; and

3.-Evaluation and interpretation of model results.

COORDINATOR: M. G. McDonald

ATTENDEES: This course may be taken by those who will be involved in simulating aquifer response to stresses and who know FORTRAN.

Attendees will be expected to know how to assemble jobs and input files using one of the editors on the PRIME computer or Wylber on the AMDAHL computer.

ATTENDANCE: Limited to 20.

Table 2.--Description of Courses--Continued

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COURSE: (G0801)

TITLE: MODELING TRANSPORT OF GROUND-WATER SOLUTES

DESCRIPTION: The purpose of this 2-week course is to introduce Water Resources Division professionals, already proficient in ground-water flow modeling, to modern numerical methods for modeling transport of conservative and reacting solutes in ground-water with approximately equal density. At the outset of the course the following fundamental concepts are introduced:

1.-Partial differential equations of solute transport in porous media; and

2.-Rudiments of chemistry required, when chemical effects are considered.

Subsequently, the Galerkin finite-element method is presented. In order to learn the essence of this method and the ways of introducing the chemical influences into transport models, the students themselves will program Galerkin models (with linear basis functions) for one-dimensional transport of solutes. Systems treated will be ones with either simple (one component, linear or non-linear) or more complex (two component, linear) chemical effects. Some of these one-dimensional models may be useful in connection with problems involving recharge-water solutes. In the second part of the course, students will be taught how to use realistic, two-dimensional transport models. These models describe transport of ground-water solutes which are either conservative or subject to simple (single component, linear) chemical effects. Models using the following methods will be presented:

1.-Finite-difference model;

2.-Method-of-characteristics model; and

3.-Finite-element model.

COORDINATOR: Jacob Rubin

ATTENDEES: Personnel must:

1.-Be experienced in quantitative ground-water analysis;

2.-Have had ample experience with computer programming;

3.-Be familiar with differential equations of ground-water flow;

4.-Have some background in chemistry and geochemistry including at least high school chemistry; and

5.-Have training or experience with digital modeling of ground-water systems, using FORTRAN IV. 5.-Have taken the WRD course (G0911) MODELING OF GROUND-WATER FLOW or (G0961) MODELING OF GROUND-WATER FLOW USING FINITE-DIFFERENCE METHODS or have equivalent training or experience in digital modeling of ground-water systems using FORTRAN IV; and

6.-As an essential preparation for this course, the trainee must have programmed a sample one-dimensional ground-water flow problem and have submitted the program output to the course coordinator two weeks before commencement of the course.

(The problem will be sent out to the course nominees at least two months before commencement of the course. The students will use their solutions to this problem as a starting point for solving the first two programming problems of the course.)

ATTENDANCE: Limited to 20.

Table 2.--Description of Courses--Continued

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COURSE: (G0194)

TITLE: NUMERICAL ANALYSIS FOR ONE-DIMENSIONAL STREAMFLOW MODELS

DESCRIPTION: This is a 2-week course. The first week includes emphasis on practical understanding of basic numerical analyses of the partial differential equations applicable to streamflow problems. This understanding is reinforced by the students programming simple numerical models illustrating the principal methods of analysis. The second week includes introduction of general purpose, sophisticated numerical models of one-dimensional flow. The student learns to modify the programs for these models to solve flow routing, slope-discharge, estuarine flow, transient storage above bridges, and lake circulation problems. Solutions to these problems involve treatment of data from on-going field projects.

COORDINATOR: P. H. Carrigan

ATTENDEES: Personnel must have:

- 1.-Experience in computer programming;
- 2.-Completed a first-year college course in calculus; and
- 3.-Immediate project-related need for knowledge involving numerical analyses of streamflow.

ATTENDANCE: Limited to 16.

Table 2.--Description of Courses--Continued

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COURSE: (G0061)

TITLE: OPERATION AND MAINTENANCE OF GEOPHYSICAL LOGGING EQUIPMENT

DESCRIPTION: This 3-day course combines classroom and field training on geophysical-logging equipment. Specifically, the course will train a geophysical-logging operator to operate and perform maintenance on Borehole Geophysical Services Unit equipment. Common field problems normally encountered in the mechanical and electronic components of geophysical loggers (Mount Sopris or Well Reconnaissance) will be covered.

COORDINATOR: A. J. Boettcher

ATTENDEES: This course is designed for hydrologists and technicians who have little or no background in the operation or maintenance of geophysical logging equipment.

ATTENDANCE: Limited to 20.



Table 2.--Description of Courses--Continued

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COURSE: (G0232)

TITLE: ORGANIC SUBSTANCES IN WATER

DESCRIPTION: This 5-day course is intended to provide background fundamentals and describe techniques available for studying the sources, behavior, and fate of organic substances in surface and ground water. Both natural and man-made compounds are considered. Techniques for sampling, sample processing, availability and limitations of analytical methodology, and the evaluation and interpretation of data are discussed.

COORDINATOR: W. L. Bradford

ATTENDEES: District water-quality specialists and project personnel responsible for planning and executing water-quality studies.

ATTENDANCE: Limited to 30.

Table 2.--Description of Courses--Continued

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COURSE: (G0894)

TITLE: ORIENTATION FOR NEW WRD EMPLOYEES

DESCRIPTION: This five-day course which will be offered at the National Headquarters in Reston is intended to introduce new employees to the leaders, mission, organization, philosophy, and policies of the Water Resources Division. The course will promote understanding of the Division's technical operations, research program, thrust programs, and future trends in organizational development. The structure and operation of the Regions and Districts will be discussed with examples from across the country. Project planning and management will be explained. The essentials of working for the government (time and attendance, career development, equal opportunity, benefits, and individual rights as a government employee) as well as essential reference publications for scientific and technical employees will be discussed.

COORDINATOR: J. E. Moore

ATTENDEES: New career professional scientific and technical employees.

ATTENDANCE: Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0942)

TITLE: ORIENTATION TO WATER-QUALITY ACTIVITIES IN WRD

DESCRIPTION: This 5-day course will familiarize the attendees with the broad scope of water-quality activities carried out by the Division. Special emphasis will be placed on Water Resources Division practices and policies related to the acquisition and dissemination of water-quality information. The course will provide information that will be useful in planning, conducting, and overseeing water quality services; processing and publishing data; and in assuring the quality of products. An overview of the Division's District, research, and national programs in water quality will be provided. The course is intended to be informative rather than instructional.

COORDINATOR: W. L. Bradford

ATTENDEES: The course is designed primarily for new Division employees who will be actively involved in Water Quality activities; however, the course is open to all Water Resources Division employees. Due to the nature of the course, attendance will be restricted to Water Resources Division personnel only.

ATTENDANCE: Limited to 40.

Table 2.--Description of Courses--Continued

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COURSE:	(G0931)
TITLE:	PARAMETER ESTIMATION TECHNIQUES FOR GROUND-WATER MODELS
DESCRIPTION:	<p>This is a hybrid course consisting of about 3-months of home study followed by a 5-day course of intensive study at the National Training Center. The course is intended to describe numerical methods of:</p> <ol style="list-style-type: none"><li>1.-Estimation of values for the parameters (transmissivity or hydraulic conductivity, leakance of confining beds, recharge, discharge, boundary flows, and boundary heads) for models of steady-state ground-water flow; and</li><li>2.-Analyzing the parameter estimates and the resulting model in terms of reliability and significance of the estimated parameters and reliability of the calculated head distribution and predictions to be made with the model.</li></ol> <p>The self-study part of the course will cover basic statistical concepts necessary for model analyses and linear regression techniques for solution of simple ground-water flow models. It is expected that most students will spend between 40 and 60 hours on this part of the course.</p> <p>The class-room instruction will cover nonlinear regression solution of general ground-water flow models and statistical analysis of the models. This part of the course will be held at the National Training Center.</p> <p>Although course emphasis is on regression solution of steady-state numerical ground-water flow models, the course is intended to teach general concepts that can be applied to many different types of models. Problem sets exercise the student on virtually all facets of the course material. A set of operational computer programs will be available so that the course participants will be able to carry out the exercises and perform analyses themselves upon course completion. The basic numerical ground-water model employed uses the integrated finite-difference methodology.</p>
COORDINATOR:	R. L. Cooley

ATTENDEES: Attendees must:

1.-Be Water Resources Division employees experienced in ground-water quantitative analysis;

2.-Have attended the no longer available training course (G0911) MODELING OF GROUND-WATER FLOW or the course (G0961) MODELING OF GROUND-WATER FLOW USING FINITE-DIFFERENCE METHODS or the course (G0971) FINITE-ELEMENT MODELING OF GROUND-WATER FLOW and have used and be familiar with the material presented in the courses (or have equivalent background); and

3.-Be engaged in a project in which the parameter estimation techniques can be applied in the next 1 or 2 years.

ATTENDANCE: Limited to 20.

Table 2.--*Description of Courses*--Continued

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COURSE: (G0064)

TITLE: PROJECT PLANNING AND MANAGEMENT

DESCRIPTION: The purpose of this 3-day workshop is to provide guidelines for systematic project planning and management. The workshop will include lectures and discussions on the planning and management of projects. The agenda for the course includes:

- 1.-How to plan a project;
- 2.-Planning project costs;
- 3.-The ideal project;
- 4.-How to manage a project;
- 5.-Project document file;
- 6.-Project review;
- 7.-Decision analysis;
- 8.-Non-ideal projects;
- 9.-Management principles;
- 10.-Report policies;
- 11.-Report planning and management;
- 12.-Report review and evaluation; and
- 13.-How to improve reports.

COORDINATOR: J. E. Moore

ATTENDEES: Personnel who are or will be project managers.

ATTENDANCE: Limited to 20.

Table 2.--Description of Courses--Continued

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COURSE: (G0414)

TITLE: REPORT COLLEAGUE REVIEW

DESCRIPTION: This 3-day course combines lectures and class problems on the principles and techniques of reviewing technical reports. Emphasis will be placed on the importance and role of colleague review in the report review process, and guidelines will be presented for performing quality colleague reviews. The agenda for the course includes:

- 1.-Philosophy of colleague reviews;
- 2.-Overview of the WRD review and approval process;
- 3.-Technical evaluation;
- 4.-Evaluation of Survey policy;
- 5.-Sources of information for colleague reviewers;
- 6.-Acknowledging colleague review;
- 7.-Procedures for colleague review; and
- 8.-Methods of improving colleague review.

COORDINATOR: J. E. Moore

ATTENDEES: Professional employees who are or will be assigned to report review.

ATTENDANCE: Limited to 20.

Table 2.--Description of Courses--Continued

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COURSE: (G0144)

TITLE: REPORT PLANNING, POLICY, AND REVIEW FOR NEW AUTHORS

DESCRIPTION: This 4-day course combines lectures and class problems on basic techniques for organizing, writing, and reviewing technical reports. Report planning, policy, review, and approval procedures will be described. Emphasis will be placed on providing guidelines for insuring the quality, timeliness, readability, and attractiveness of our reports. The agenda for the course includes:

- 1.-Project and report planning and management;
- 2.-Report policy;
- 3.-Report writing aids;
- 4.-Guidelines for preparing outlines and report components;
- 5.-Report format;
- 6.-Report review; and
- 7.-Report improvement.

COORDINATOR: J. E. Moore

ATTENDANCE: Limited to 24.



Table 2.--Description of Courses--Continued

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COURSE: (G0264)

TITLE: REPORT PLANNING POLICY AND MANAGEMENT FOR NEW SUPERVISORS

DESCRIPTION: This 4-day course will provide guidelines for improving the planning and preparation of reports. A systematic approach designed to insure the quality, timeliness, and readability of Survey reports is stressed. The course will provide current information on report format, report contents, illustrations, and press releases. Emphasis will be placed on report policy, supervisory report responsibility, methods to improve reports, and technical colleague review. The agenda for the course includes:

- 1.-Report planning and management;
- 2.-Report assistance;
- 3.-Report review and evaluation;
- 4.-Report problems;
- 5.-Report policy;
- 6.-Methods to improve report; and
- 7.-Discussion of District report problems.

COORDINATOR: J. E. Moore

ATTENDEES: The course is designed for new District Chiefs and management personnel who are responsible for reports.

ATTENDANCE: Limited to 20.

Table 2.--Description of Courses--Continued

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COURSE: (G0974)

TITLE: SAS FOR WATER RESOURCES DATA

DESCRIPTION: This 5-day course is designed to provide attendees with an introduction to the use of Statistical Analysis System (SAS) with the seven major Water Resources Division data files: Water Quality, Daily Values, Peak Flow, Unit Values, Ground-Water Site Inventory, Basin Characteristics, and Header Information. The course will discuss Job Control Language (JCL) and sample problems will be run on the computer. Permanent data sets on both tape and disk will be demonstrated. Many important procedures within SAS will be applied to data from various combinations of the major files. Attendees will have the opportunity to run SAS jobs during evening sessions.

COORDINATOR: D. V. Maddy

ATTENDEES: The course is intended for personnel with need to analyze water-resources data from the major files.

ATTENDANCE: Limited to 25.

Table 2.--Description of Courses--Continued

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COURSE: (G0174)

TITLE: SATELLITE DATA-COLLECTION PLATFORM INSTALLATION AND OPERATION

DESCRIPTION: This 5-day workshop is designed to train personnel in the telemetry of hydrologic data using satellite data-collection systems. The practical aspects of the installation and operation of the LaBarge, Synergetics, Sutron and Handar data-collection platforms will be emphasized. Classroom training will include an overview of satellite data-collection systems, instrument interfacing to platforms, programming platforms for operation, and an overview of data processing activities. The participants will be provided ample "hands-on" experience installing a data-collection platform for actual operation through the GOES Data Collection Systems.

COORDINATOR: W. G. Shope

ATTENDEES: Personnel who are or soon will be actively engaged in the installation of data-collection platforms may attend.

ATTENDANCE: Limited to 20.

Table 2.--Description of Courses--Continued

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COURSE: (G0912)

TITLE: SEDIMENT DATA-COLLECTION TECHNIQUES

DESCRIPTION: This 5-day course is a workshop providing training in the fundamentals of sediment data collection. Trainees will spend 1-2 days in the field collecting suspended-sediment and bed-material samples using most of the available samplers. Emphasis will be on careful study of the various techniques that can be used to collect representative samples of water-sediment mixtures. A brief exposure to laboratory practices and to sediment record computation will be included.

COORDINATOR: J. R. Ritter or Dallas Childers

ATTENDEES: Personnel who are actively engaged in sediment activities or those who plan to become involved prior to the next presentation of the course.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0962)

TITLE: SEDIMENT RECORDS COMPUTATION AND INTERPRETATION

DESCRIPTION: This 5-day course is a workshop designed to provide training in the computation of sediment-discharge records of both suspended sediment and bedload. It will include the use of data collected on a daily or near daily basis also and that collected on a periodic or intermittent basis. Emphasis will be placed on analysis and interpretation of records and on types of records for various data needs.

COORDINATOR: B. H. Ringen

ATTENDEES: Personnel who are engaged in the following activities are eligible to attend:

1.-Those currently engaged in sediment record computation and data handling;

2.-Supervisors who need more background in the analysis and interpretation of sediment records;

3.-Program planners who need more information on designing data-collection programs to meet data needs.

Prerequisite for this course is (G0912) SEDIMENT DATA-COLLECTION TECHNIQUES or equivalent experience. Participation or equivalent experience in the no longer available course (G0922) SEDIMENT LABORATORY TECHNIQUES would also be acceptable.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0054)

TITLE: SEMINAR FOR NAWDEX ASSISTANCE CENTERS

DESCRIPTION: This 4-day seminar provides instructions and class workshops in the functions and operation of the Assistance Centers of the National Water Data Exchange (NAWDEX). Emphasis is placed on receipt of and response to data-user requests for water-data information, and the use of the NAWDEX data bases and information products to specifically identify and locate requested water data and data-source organizations. Documentation and instructions are also given in the use of the new NAWDEX User Accounting System data base for automated request tracking and computer-generated quarterly reports. An overview is provided on NAWDEX services and products that are available through NAWDEX data-base systems and member organizations.

This session does not include detailed instruction in the use of System 2000 Natural Language and the NAWDEX data systems. Instruction in these areas is offered in the courses entitled (G0941) SYSTEM 2000 NATURAL LANGUAGE (VERSION 2.9) RETRIEVAL COMMANDS and SEMINAR ON NAWDEX DATA SYSTEMS.

COORDINATOR: G. L. Thompson

ATTENDEES: Attendees should be those individuals serving as NAWDEX Assistance Center Contacts who have the responsibility for receive, responding to and reporting requests for water-data or information.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0674)

TITLE: SEMINAR FOR WATER RESOURCES DIVISION MANAGERS

DESCRIPTION: This 5-day course will cover a number of concepts that should be of value to Water Resources Division Managers. Included will be subjects such as leadership style, decision making, power and leadership, assessment of interpersonal style, improving interpersonal skills and productivity, and predicting and managing human behavior.

Most of the course will be presented by management consultants. Each participant will receive constructive feedback on how others see their interpersonal skills as compared with how they see these skills themselves. This seminar should offer WRD managers the opportunity to become familiar with a number of management concepts in a setting with other WRD managers.

COORDINATOR: T. J. Buchanan

ATTENDEES: The course is intended for Water Resources Division Managers. Included in this category will be District Chiefs, Assistant District Chiefs, and any other managers nominated by members of the Senior Staff.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0044)

TITLE: SEMINAR ON NAWDEX DATA SYSTEMS

DESCRIPTION: This 4-day Seminar provides instruction and workshops in the use of the National Data Exchange (NAWDEX) data bases and associated software. Emphasis will be placed on new features resulting from the redesign of the Master Water Data Index (MWDI) data base and its associated software. Instruction is provided for the retrieval of data from the MWDI data base to generate listings, ad hoc reports, reports for publications, data base summaries, plots, use of the Xerox 9700 for processing pre-formatted reports from the MWDI, and generating microfiche. Instruction in the use of the Water Data Sources Directory (WDSO) and associated software as well as on the encoding, editing, and submission of data for both data bases is also provided.

This session does not include detailed instruction in the use of SYSTEM 2000 Natural Language which is offered in the course entitled (G0941) SYSTEM 2000 NATURAL LANGUAGE (version 2.9) RETRIEVAL COMMANDS.

COORDINATOR: O. O. Williams

ATTENDEES: Participants should be those having "hands-on" responsibilities for the computer processing, storage, and retrieval of data in the NAWDEX data bases.

ATTENDANCE: Limited to 24.



Table 2.--Description of Courses--Continued

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COURSE: (G0062)

TITLE: STATISTICAL ANALYSIS OF WATER-QUALITY DATA

DESCRIPTION: This 5-day workshop is designed to provide attendees with an introduction to statistics and a computer package, Statistical Analysis System (SAS), which can be used for statistical analysis of hydrologic data. The course will cover sampling statistics, statistical testing, regression analysis, analysis of variance and covariance, and provide a working knowledge of the computer program package SAS. The emphasis of the course will be on statistical analysis of water-quality data stored in WATSTORE. Attendees will have a opportunity to run SAS jobs on the computer during evening sessions.

COORDINATOR: D. A. Goolsby

ATTENDEES: The course is intended for personnel who are or will be involved in projects or data handling activities that require statistical analysis of hydrologic data. An introductory course in statistics and a basic algebra course is required.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE:	(G0113)
TITLE:	STATISTICAL APPROACH TO SURFACE-WATER HYDROLOGIC ANALYSIS
DESCRIPTION:	<p>This 2-week course is composed of explanation, discussion, and solution of hydrologic problems related to streamflow. Practice in solving hydrologic problems is acquired through manual computations as well as utilizing procedures in the Statistical Analysis System (SAS). Principle subjects covered are:</p> <ol style="list-style-type: none"><li>1.-Statistical concepts and definitions, accuracy of streamflow characteristics;</li><li>2.-Statistical analysis of streamflow data using computer programs in WATSTORE;</li><li>3.-Discussion of theory and assumptions underlying regression analysis, analysis of variance and covariance;</li><li>4.-Regionalization of streamflow characteristics using multiple regression techniques;</li><li>5.-Discussions of weighted least squares regression, nonlinear regression, ridge regression, cluster and discriminant analysis;</li><li>6.-Extending streamflow records in time;</li><li>7.-Synthetic hydrology;</li><li>8.-Trend analysis;</li><li>9.-Low-flow programs; and</li><li>10.-Selected research topics.</li></ol>
COORDINATOR:	W. O. Thomas, Jr.
ATTENDEES:	<p>Personnel must:</p> <ol style="list-style-type: none"><li>1.-Be actively engaged or anticipate involvement in surface-water hydrologic projects;</li><li>2.-Have previous instruction in statistics (college level course, correspondence course, etc.); and</li><li>3.-Be mathematically inclined with a desire to better understand statistical techniques used to analyze and interpret surface-water data.</li></ol>

The (G0333-C) PROBABILITY FOR HYDROLOGISTS video tape correspondence course or equivalent training will become prerequisite for this 2-week course before 1986.

Personnel who attended the previous version of this course, (G0113) SURFACE-WATER HYDRAULIC ANALYSIS, are eligible to take this course.

ATTENDANCE: Limited to 30.

Table 2.--Description of Courses--Continued

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COURSE: (G0821)

TITLE: SURFACE GEOPHYSICS IN WATER RESOURCES INVESTIGATIONS

DESCRIPTION: This 5-day course includes discussions of theory, interpretation exercises, and field methods of various surface geophysical techniques such as; gravity, seismic, electromagnetic, and electrical resistivity. Specific applications of these methods to a variety of hydrologic problems, such as aquifer delineation, contamination plume delineation, salt-water interface mapping, water-table mapping, etc., will be emphasized. Geophysicists from the Region Geophysics Branch (Geologic Division) and WRD personnel specializing in hydrologic applications will serve as instructors.

COORDINATOR: F. P. Haeni

ATTENDEES: Personnel who are or who will be engaged in, or supervisors of projects requiring surface geophysics are encouraged to attend.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0093)

TITLE: SURFACE-WATER HYDRAULIC ANALYSES

DESCRIPTION: This 2-week course combines lectures and analyses of surface-water hydraulic problems. The subject matter includes:

- 1.-Stage-discharge rating analyses;
- 2.-Rating of control structures;
- 3.-Computation of water-surface profiles as related to rating-curve analysis and flood mapping;
- 4.-Hydraulics of culvert openings and of bridges, including bridge-site analysis; and
- 5.-Indirect measurements of discharge by the slope-area, constricted-opening, culvert, and weir flow methods.

Participants for the (G0093) SURFACE-WATER HYDRAULIC ANALYSES course must have attended the course (G0043) BASIC HYDRAULIC PRINCIPLES or have completed college-level courses in hydraulics or fluid mechanics.

COORDINATOR: J. O. Shearman

ATTENDEES: Hydrologists who need to apply hydraulic principles in their present or future assignments.

ATTENDANCE: Limited to 16.

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COURSE: (G0072)

TITLE: SURFACE-WATER QUALITY MODELING

DESCRIPTION: This is a hybrid course consisting of a self-paced home study part to be completed during a six month period followed by a two-week "hands-on" classroom part at the National Training Center in Denver.

The self-paced home study part of the course includes study of mathematical background for both the Lagrangian and Eulerian approach to surface-water transport and familiarization with computer programs written to implement each approach.

The mathematical section will include detailed derivation of the governing differential equations and the subsequent solution algorithms leading to the algebraic forms suitable for use by the computer programs. The computer section will provide trainees with complete program documentation and "hands-on" experience with the computer models for simple simulations. The examples will include the use of user-prepared subroutines and/or code modifications to configure the models for specific simulation requirements. The models will be available on the WRD Distributed Information System utilizing the PRIME minicomputers.

The two-week session in Denver will be devoted to the process of water-quality modeling. Both models will be used for selected problems demonstrating the types of situations for which each is most suited. Each simulation example will include criteria for selecting the appropriate model, preparing and input of data, selection and coding of reaction coefficient algorithms, and interpretation and evaluation of model output. The example simulations will be selected to demonstrate the flexibility of the computer models and provide experience and in-depth understanding of all aspects of a surface-water quality modeling project.

COORDINATOR: J. V. Schornick Jr.

ATTENDEES: This course is designed for professional employees who are actively engaged in or are expected to be actively engaged in a surface-water quality modeling project in the near future. A background in water-quality project work and basic skills in Fortran programming are desirable.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0000)

TITLE: TECHNIQUES OF HYDROLOGIC INVESTIGATIONS FOR INTERNATIONAL PARTICIPANTS

DESCRIPTION: This 8-week course is designed to instruct the participating foreign hydrologists in the techniques and methods used by the U. S. Geological Survey for collecting hydrologic data and interpreting that data to evaluate the water resources of an area or region. Data-collection techniques will include "hands-on" field methods of measuring and recording data and office procedures for processing and storing the data. Interpretative techniques will include graphical, analytical, and computer methods of analyzing data to determine hydrologic parameters and interrelationships. The interdisciplinary subject material will be presented in discipline groups--surface water, ground water, and water quality--but with an overall adherence to the concept that each discipline is only one aspect of the total hydrologic system. In this way, the participants will be able to learn the techniques and methods used in his or her own field of interest and how that field relates to and is affected by the total system. The participants will, thus, be prepared to effectively present all of the techniques and methods to their colleagues regardless of the particular discipline.

Each participant will be requested give a 30-minute presentation covering the hydrology, hydrological problems, culture, and other areas of interest relating to their country. Participants are encouraged to bring slides, pictures, maps, etc., to facilitate this presentation.

COORDINATOR: W. R. Hotchkiss

ATTENDEES: The attendees should be practicing hydrologists with direct responsibility in planning and performing hydrologic investigations and in training of technicians and/or colleagues. The attendees should have the equivalent of a Bachelor's degree in science or engineering. In addition, attendees should provide English language facility test scores or acceptable verification of English language proficiency since all instruction will be in English. Information on English language facility testing can be obtained at the American Embassy or Consulate in each country.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0951)

TITLE: TEST WELL DRILLING CONTRACTS

DESCRIPTION: This 3-day course describes the steps necessary in procuring a contractor to perform test well drilling to the project specifications. It covers methods used in well drilling to help in writing effective specifications for the Contractor. Steps in preparation of wage surveys, requisitions, driller's lists, specifications, and special forms are explained. Special problems in sampling, grouting, and legal matters are discussed. Borehole geophysical tests are explained. The relative merits of inhouse versus contracted drilling are evaluated.

COORDINATOR: J. E. Heisel

ATTENDEES: This course is designed for personnel who will be responsible for well drilling programs in ground-water flow, modeling, or toxic waste investigations.

ATTENDANCE: Limited to 20.



Table 2.--Description of Courses--Continued

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COURSE:	(G0034)
TITLE:	THEORY AND APPLICATION OF TRACERS IN HYDROLOGIC STUDIES
DESCRIPTION:	<p>This 5-day highly specialized course is intended to cover the basics of fluorometry; the properties and use of various dyes; the concepts and models for time of travel, dispersion and mixing, and linear decay of wastes in streams and estuaries; the basics of dilution gaging, and the application of hydrocarbon gas tracers to measure the reaeration coefficient in small streams. The course will emphasize student participation in:</p> <ol style="list-style-type: none"><li>1.-Dye tests for time of travel, dilution discharge measurement, and reaeration coefficient measurement;</li><li>2.-Laboratory use of fluorometry equipment, preparation of dye standards, and analysis of field samples; and</li><li>3.-Computation, interpretation, and presentation of results.</li></ol>
COORDINATOR:	F. A. Kilpatrick
ATTENDEES:	This course requires college level knowledge of mathematics and fluid mechanics; participants will be limited to personnel with pertinent educational background.
ATTENDANCE:	Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0841)

TITLE: UNSATURATED FLOW IN POROUS MEDIA

DESCRIPTION: This two week course describes the basic principles governing the occurrence and movement of water in the unsaturated zone. Methods of measurement of the hydraulic properties of unsaturated materials are taught through lecture, laboratory experimentation, and class problems. Methods of measuring or estimating evapotranspiration also are discussed. Analytical solutions of governing steady flow will be presented with class exercises demonstrating their use. Numerical techniques to analyze transient unsaturated flow will be taught. The class participants will also use a documented 2-D saturated-unsaturated flow model to simulate unsteady unsaturated flow for some practical problems. Project applications include those requiring estimates of ground-water contribution to evapotranspiration, effects of changes in land use on ground-water recharge, and prediction of and timing of irrigation return flows. The course also should be useful to project personnel involved in studies of artificial recharge and of pollution hazards from dumps or ponds, and other surface sources of ground-water pollution. The course also may be useful to those involved in projects considering overland runoff.

COORDINATOR: E. P. Weeks

ATTENDEES: Attendees must be:

1.-Water Resources Division employees experienced in quantitative ground-water analysis;

2.-Familiar with differential equations of flow;

3.-Have taken either courses in ground-water flow modeling or (G0194) NUMERICAL ANALYSIS FOR ONE-DIMENSIONAL STREAMFLOW MODELS, or have the equivalent training or experience with numerical analysis of ground-water flow problems using FORTRAN; and

4.-Project requiring knowledge of water movement in the unsaturated zone.

ATTENDANCE: Limited to 15.

Table 2.--Description of Courses--Continued

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COURSE: (G0122)

TITLE: WATER-QUALITY CONCEPTS FOR NEW PROFESSIONALS

DESCRIPTION: This introductory 5-day course is designed primarily for professionals who expect to become actively engaged in water quality activities. The course will include a study of the concepts of the inorganic and organic geochemistry (including the behavior of hazardous organic substances) of water, sedimentation and erosion processes, aquatic ecology and microbiology, sampling, and the design of water resources investigations.

COORDINATOR: W. L. Bradford

ATTENDEES: This course is designed primarily for new professionals in the water quality program, including those recently placed on the personnel roles or those whose experience has been in a hydrological field other than water quality.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0992)

TITLE: WATER-QUALITY DATA PROCESSING ON THE PRIME

DESCRIPTION: The 5-day workshop will include discussions and sample problems regarding the entry, update, and retrieval of water-quality data. The workshop will use screens and line entry interactively, in both the water-quality data processing and the access to support files such as the Station Header File, the Parameter Code File, the Geologic Unit Code File, and the State/County Code File. The workshop will include demonstrations and use of the sample Login program, the Entry of Field Data program, the Data Edit program, the Data Validation program, the Data Retrieval program, and the Data Tabling program.

COORDINATOR: C. R. Showen

ATTENDEES: The course is designed for personnel familiar with the PRIME operating system and actively involved in the processing of water-quality data.

ATTENDANCE: Limited to 24.

Table 2.--Description of Courses--Continued

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COURSE: (G0083)

TITLE: WATERSHED SYSTEMS MODELING

DESCRIPTION: This 5-day course is designed for Water Resource Division hydrologists to analyze and predict the hydrologic impacts of land-use change. Basic hydrologic processes, such as precipitation, snow accumulation and melt, evapotranspiration, infiltration, runoff, overland and channel flow routing and erosion and sediment transport, will be presented in the context of watershed models. Water-quality simulation will be introduced. Model calibration, verification, sensitivity analysis, and optimization will be presented and attendees will gain hands-on experience with each analysis. Instructions on data management for watershed models on the PRIME computer will be provided. Lectures will be given in the morning and the afternoon will be used for discussions and to run model simulation and data-management programs for class problems.

COORDINATOR: Alan Lumb

ATTENDEES: Hydrologists interested in projects to assess the hydrologic impacts of surface mining, urban development, or other changes in land use or the drainage system. Some understanding of basic hydraulics and water-quality processes would be helpful.

ATTENDANCE: Limited to 16.

Table 3.--Description of correspondence and self-paced courses

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COURSE:	(G0041-C)
TITLE:	FINITE-DIFFERENCE NUMERICAL METHODS IN HYDROLOGY
DEVELOPED BY:	Irwin Remson of Stanford University, F. J. Molz of Auburn University, and G. M. Hornberger of the University of Virginia.
ADMINISTERED BY:	The National Training Center
DESCRIPTION:	<p>The course is designed for employees who require a knowledge of the basic finite-difference methodology and who have completed courses in algebra and introductory calculus. Although most of the problem examples are from ground-water hydrology, the course is applicable to all disciplines.</p> <p>Participants will learn the fundamentals of numerical techniques for approximating solutions to different types of hydrologic problems. This knowledge is useful for some of the introductory modeling courses offered at the U. S. Geological Survey National Training Center.</p>
NOMINATIONS:	Nominations should be made by memorandum to the Chief of the National Training Center through the appropriate Regional Hydrologist. The following information should be included in the memorandum: the nominee's full name, title, grade, social security number, location, service computation date, date of birth, and the account number to be charged for the training. Nominations may be submitted throughout the year, but the course will be initiated periodically.
APPLICATIONS:	A mass training form will be prepared by the Training Center and each account will be journal vouchered for the cost of the training. Copies of the training form and the journal voucher will be sent to each participant along with the course materials.
TEXT(S):	Syllabus and excerpted references will be supplied by the National Training Center; NUMERICAL METHODS IN SUBSURFACE HYDROLOGY by Irwin Remson, G. M. Hornberger, and F. J. Molz, 1971, John Wiley and Sons, Inc. must be obtained by the trainee.
TIME ALLOTMENT:	Approximately 80 Hours are required.
CREDIT(S):	None
COST:	\$180 for training, \$20 for book.

Table 3.--*Description of correspondence and self-paced courses*--Continued

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COURSE:	(G0761-S)
TITLE:	GROUND-WATER CONCEPTS (SELF-PACED VERSION)
DEVELOPED BY:	Ground-Water Branch, Water Resources Division
ADMINISTERED BY:	Ground-Water Branch and the National Training Center
DESCRIPTION:	<p>This is a self-paced course that stresses the basic physical and mathematical concepts that are requisite to the understanding of ground-water systems. Emphasis is placed on a review of fundamentals, Darcy's Law, ground-water storage, the differential equations of flow, boundary conditions superposition, medium coefficients, and analytical solutions. Finite-difference concepts are developed in detail by reference to electrical analogy and the governing equations. Throughout this course, participants will reinforce theoretical concepts with problems requiring hand calculations and laboratory exercises using electrical models. The course is a logical, although not required, prerequisite to other Survey courses that involve modeling of ground-water flow and solute transport. However, taking the course after taking the other courses would be beneficial to most hydrologists.</p> <p>The course is patterned after the 2-week (G0761) GROUND-WATER CONCEPTS Course that has been offered at least once per year for several years and will continue to be offered on a limited basis at the National Training Center. The course materials for the 2-week course were adapted for the self-paced course by the addition of new materials, explanations to existing materials, and supplemental readings. Each participant will be assigned a District or Regional advisor in lieu of a classroom instructor. The advisor will work directly with the participant throughout the course to answer questions, provide encouragement, and formally track progress.</p>
NOMINATIONS:	<p>Nominations should be made by memorandum to the Chief of the National Training Center through the appropriate Regional Hydrologist. The following information should be included in the memorandum: the nominee's full name, title, grade, social security number, location, service computation date, date of birth, and the account number to be charged for the training. Due to limitations on equipment and advisors, only about 20 participants will be selected for the first year of training.</p>

APPLICATIONS: A mass training form will be prepared by the Training Center and each account will be journal vouchered for the cost of the training. Copies of the training form and the journal voucher will be sent to each participant along with the course materials.

TEXT(S): Instructional materials include notes and problems especially designed for the course, several hydrology text books and Survey publications.

TIME ALLOTMENT: The course will require about 150 hours and should be completed in 9-12 months.

CREDIT(S): No college credit will be given for this course.

COST: \$600 includes the cost of the required reference books.



Table 3.--Description of correspondence and self-paced courses--Continued

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COURSE:	(G0734-C)
TITLE:	INTRODUCTION TO THE FORTRAN LANGUAGE
DEVELOPED BY:	The University of Southern Mississippi
ADMINISTERED BY:	The University of Southern Mississippi
DESCRIPTION:	The course is designed for professional and technical employees who require scientific computer programming capability. Employees, with District Chief approval, may enroll in this course.
NOMINATIONS:	Direct to University of Southern Mississippi
APPLICATIONS:	Employees who are nominated shall send a completed SF-182 "Request, Authorization, Agreement and Certification of Training" directly to William Lewis, Director, Department of Independent Study, Box 56, Southern Station, University of Southern Mississippi, Hattiesburg, Mississippi 39401.
TEXT(S):	A GUIDE TO FORTRAN IV PROGRAMMING, by D. D. McCracken, 1972, John Wiley and Sons.
TIME ALLOTMENT:	Students are required to complete four chapters of IBM programmed instruction, each with a brief examination, and a final exam, within a 6 month period. The final examination booklet, containing three examinations (one each from the SW, GW, and QW disciplines) was developed by the Operational Models Project. Students select and complete one exam. This course requires approximately 80 hours for completion.
CREDIT(S):	Students will earn 3 semester hours of undergraduate credit at USM upon successful completion of the course. If a student plans to transfer credit to another university, he or she should consult with that University regarding the transfer. The course may be taken for non-credit.
COST:	\$136 (includes book). Allow one month for book delivery.

Table 3.--Description of correspondence and self-paced courses--Continued

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COURSE:	(G0333-C)
TITLE:	PROBABILITY FOR HYDROLOGISTS
DEVELOPED BY:	Maurice Bryson, Colorado State University
ADMINISTERED BY:	The National Training Center
DESCRIPTION:	<p>The course consists of 35 lessons and 33 tapes designed for employees who require an extensive knowledge of statistics and probability but who have not been exposed to statistical methods. Two years of calculus are recommended for complete understanding. However, three review lessons in college algebra, differential calculus, and integral calculus are provided with this course.</p> <p>The course will discuss such topics as basic concepts and rules of probability, families of distributions, estimation, simulation, goodness-of-fit tests, functions of random variables, decision theory, and other probability-related topics.</p> <p>Worked exercises appear at the end of the lesson outline and a few exercises also have been prepared for mailing in to the monitor. Six tests and a final exam covering the material have been prepared and will be administered by the course monitor. These tests will cover only required material; some lessons are optional.</p>
NOMINATIONS:	Nominations should be made by memorandum to the Chief of the National Training Center through the appropriate Regional Hydrologist. The following information should be included in the memorandum: the nominee's full name, title, grade, social security number, location, service computation date, date of birth, and the account number to be charged for the training. Nominations may be submitted throughout the year, but the course will be initiated periodically.
APPLICATIONS:	A mass training form will be prepared by the Training Center and each account will be journal vouchered for the cost of the training. Copies of the training form and the journal voucher will be sent to each participant along with the course materials.
TEXT(S):	The text for this course is a loose-leaf study guide and diagrams which will be mailed out to each participant accepted into the course.

TIME ALLOTMENT: A period of six months will be allowed for this course. If unforeseen factors cause a need for extension of time, you may apply to the National Training Center for additional time.

CREDIT(S): No college credit will be given for this course. The course is a logical pre-requisite to various National Training Center statistics courses.

COST: District or Project Office will buy the set of 33 video tapes at cost, (\$600). Each student will pay a registration/monitor fee, (\$200).