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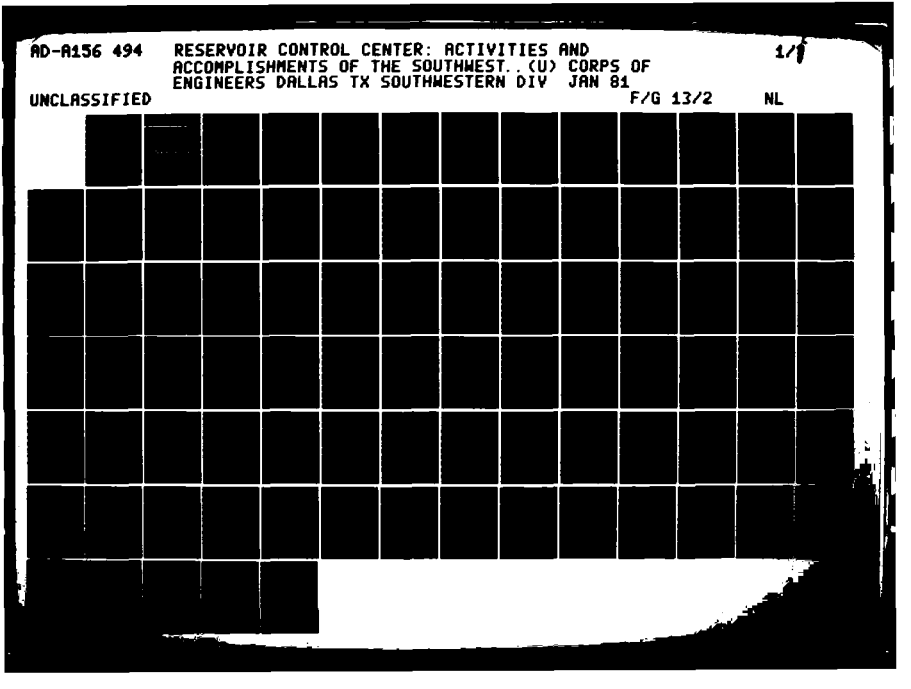

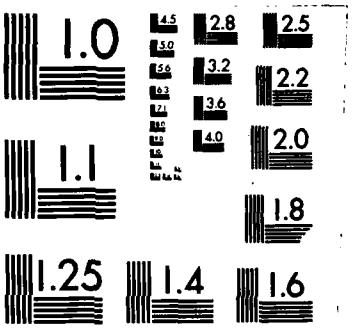

United States Army
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Southwestern Division

(3)

# Reservoir Control Center



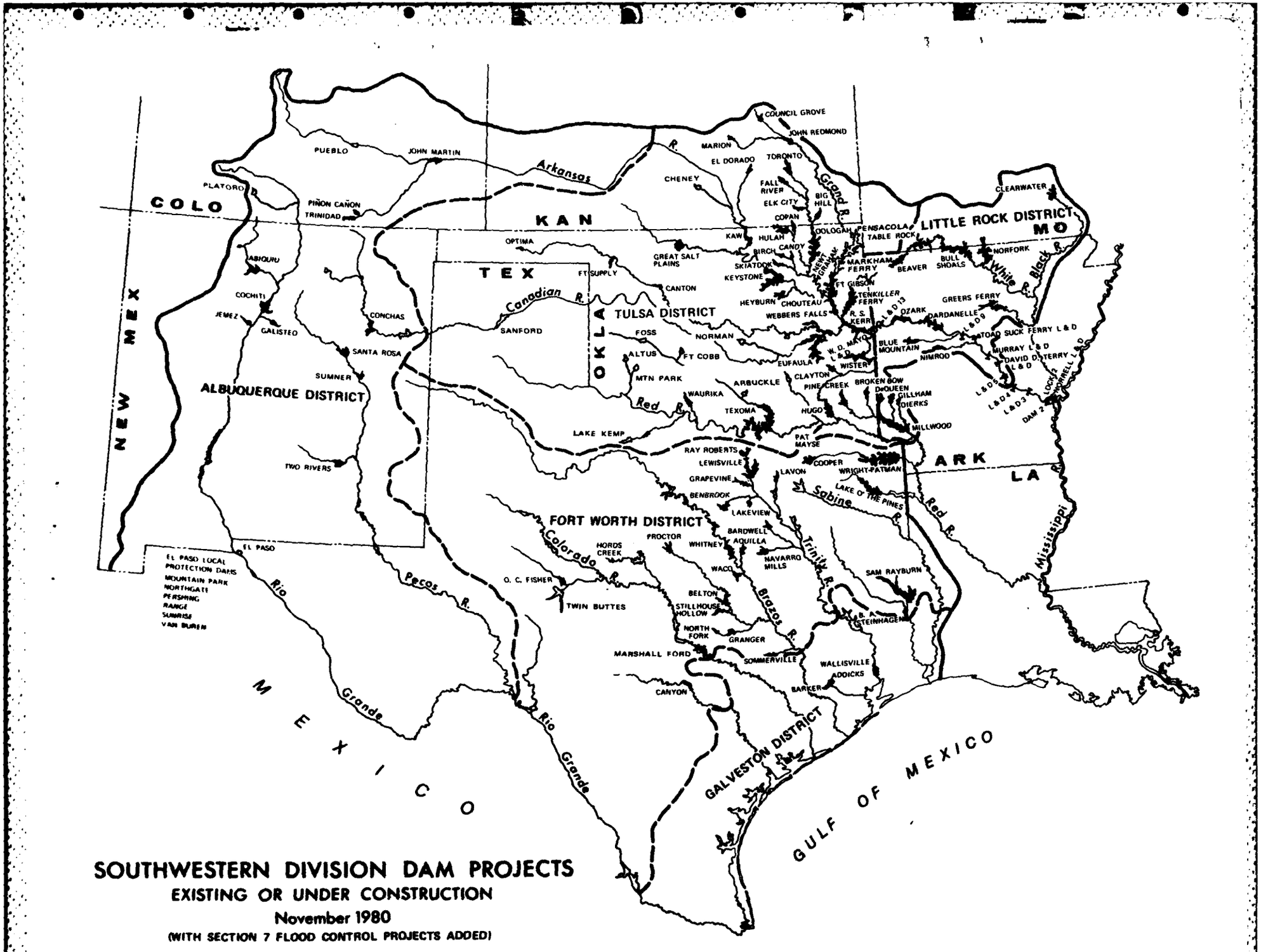
# PART I OF THE
# ANNUAL REPORT
# 1980





USArmy Corps of Engineers
Southwestern Division
Dallas, Texas

January 1981




# SOUTHWESTERN DIVISION DAM PROJECTS

## EXISTING OR UNDER CONSTRUCTION

**November 1980**

**(WITH SECTION 7 FLOOD CONTROL PROJECTS ADDED)**

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

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This report presents activities and accomplishments of the Southwestern Division (SWD) related to reservoir regulation and water management through FY 1980. Companion publications, "Parts II and III of the"Annual Report", have been prepared containing detailed summaries of the districts, and minutes of coordinating committee meetings, and instream flow problems and needs evaluation, respectively.

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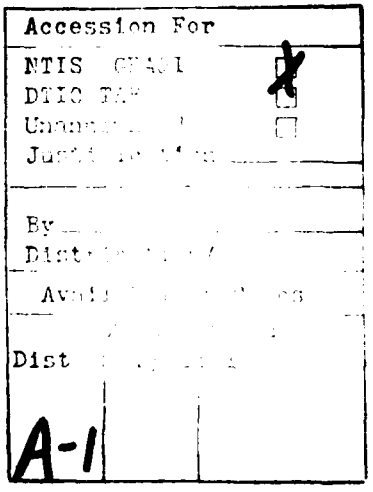
# 1980
# ANNUAL REPORT
# RESERVOIR CONTROL CENTER
# SOUTHWESTERN DIVISION

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# PART I

# RESERVOIR CONTROL CENTER

# 1980 ANNUAL REPORT

## SECTION I - INTRODUCTION

1. PURPOSE OF REPORT. This report presents activities and accomplishments of the Southwestern Division (SWD), related to reservoir regulation and water management through FY 1980. Companion publications, "Parts II and III of the Annual Report", have been prepared containing detailed summaries of reservoir conditions, water quality activities, documentation letters by the districts, and minutes of coordinating committee meetings, and instream flow problems and needs evaluation, respectively. Copies of Parts II and III are available upon request.

This report is prepared in conformance with ER 1110-2-1400, 24 April 1970, Reservoir Control Centers, paragraph 12c.

2. REFERENCES. Reservoir Control Center (RCC), SWD. Guidance Memorandum, dated June 1971, approved by the Chief of Engineers as a general basis for RCC's activities.

3. OBJECTIVES OF RCC. The SWD RCC was established in 1967 by the Chief of Engineers to improve capabilities of the Corps of Engineers, SWD to perform its civil works mission as related to operation of reservoirs. It carries out its responsibilities by:

a. Organizing coordinating committees and/or participating in committees to accomplish mutual understandings among water interests regarding use and regulation of water resources.

b. Providing interbasin coordination of day-by-day regulation needs for river systems for all purposes.

c. Surveillance of daily operations and continuous analysis of project needs.

d. Furnishing technical assistance to personnel of district offices in related efforts to improve reliability of regulations and hydrologic determinations.

## SECTION II - WATER CONTROL ACTIVITIES IN SWD

### 1. RESERVOIR REGULATION

a. LAKE REGULATION IN FY 80. Regulation of all the division lakes and Section 7 lakes during FY 80 is discussed in detail in Part II, Section VII. The most significant activities resulted from moderate to severe drought conditions that were experienced in most river basins within SWD. As required by ER 1110-2-240, the Fort Worth, Little Rock, and Tulsa District Engineers were requested to prepare summaries of drought conditions within their respective districts. The following provides a brief summary of those reports.

(1) Fort Worth District. All basins within the district experienced below normal runoff since the spring months of 1980. The lack of runoff resulted in substantial pool drawdown in most projects within the district. The amount of conservation water remaining in September 1980 varied from 0 percent in O.C. Fisher and Hords Creek to 95 percent in Wright Patman Lake. Even though several projects experienced low lake levels, the district encountered no problems in meeting project purposes during the year. Although, drought conditions have persisted in the watershed above O.C. Fisher Dam since 1964 and have resulted in extended periods where the water surface has remained below the invert elevations (1878.5 feet, NGVD) of the low flow outlets which would restrict water supply releases for the city of San Angelo. Presently the city of San Angelo has sufficient water from Twin Buttes Reservoir (Section 7 project) to meet their needs and does not anticipate a need from O.C. Fisher in the near future.

(2) Little Rock District. All basins within the Little Rock District experienced drought conditions since the winter months of 1979. Accumulated basin rainfall amounts ranged from 12 to 15 inches below normal in all river basins. The Southwestern Power Administration (SWPA) have made maximum purchases of power from non-hydropower sources to reduce draft on Corps projects. The district anticipated no foreseeable problems in meeting project purposes.

(3) Tulsa District. Inflows into district projects averaged about 30 percent of median. The low inflows, along with high evaporation rates, increased demands for hydropower, and water quality releases, resulted in Corps lakes averaging about 72 percent of full conservation storage. The extremes ranged from 10 percent at Toronto to 99 percent conservation storage remaining in several lakes. The SWPA made maximum purchases of power from non-hydropower sources to reduce draft on Corps projects. Low flow releases were reduced at some projects to maintain a live stream as long as possible.

Operational data summaries for all of the SWD (including Section 7) projects are shown in tabular form, two projects per page in Section VII. An index, by basin, to these tables is included which also lists pertinent data for each project. Also included is a listing by alphabetical order giving names of both the lake and dam where different.

b. REGULATION PLANS

(1) Red River Basin Plan Of Regulation. The basin system regulation study was continued during the year. Significant accomplishments were made toward model development for both the existing basin conditions and future basin conditions (depleted flow conditions) simulations. These accomplishments were achieved through a series of meetings between the Southwestern Division, Little Rock, Tulsa, Fort Worth Districts, the Lower Mississippi River Division and New Orleans District. The following work assignments and goals were established:

| TASK | TARGET COMPLETION DATE |
|---|---|
| Existing conditions simulation | Dec 80 |
| Depleted flow conditions simulation | Mar 81 |
| Publication of Red River Master Manual | Jan 84 |

In addition to the Red River Master Manual, the results of the system regulation study will be used for:

a. The evaluation of the availability of flows to support the Red River Navigation Project for both present and future conditions of basin development.

b. The evaluation of the Red River Compact and impact upon Corps projects.

(2) Water Control Manuals. The latest "STATUS OF WATER CONTROL MANUALS IN SWD" which is included in Part II of this report shows the status and completion schedule through FY 1983 for manuals on 113 lakes and 12 river systems. At the end of FY 1980, there were 88 Corps of Engineers projects (71 lakes and 17 locks and dams) and 16 Section 7 lakes in operation in SWD. During FY 1980 impoundment began at Granger Lake on 21 January 1980 and North Fork Lake on 3 March 1980, located on the San Gabriel River and the North Fork San Gabriel, respectively. Impoundment is scheduled to begin in September 1981 for Clayton Lake which will be located on Jackfork Creek of the Kiamichi River.

During FY 1980 the SWD Reservoir Control Center received and reviewed ten (10) water control manuals that were submitted by the districts in the form of new manuals, revisions to old manuals, and plans of regulation (chapters 7 & 8 of ETL 1110-2-241). The master manual for Arkansas River Basin was submitted and approved this year which completed an extensive long term regulation study for the basin. The Reservoir Control Center continued to stress the importance of the best plan development, their documentation, and ultimately their implementation. The schedule for FY 81 includes the completion of seven new manuals and revisions of manuals for five projects.

(3) Section 7 Project Regulation. Within SWD there are 16 reservoirs owned and operated by other agencies and which contain flood storage regulated by the Corps in accordance with Section 7 of the Flood

Control Act of 1944. The districts are continuing efforts to bring the manuals and regulation plans into compliance with requirements contained in paragraph 208.11, Part 208 Flood Control Regulations, Chapter II, Title 33 of the Code of Federal Regulations (41 FR 20401, May 18, 1976). The adopted plan of regulation for Marshall Ford Reservoir was published in the Federal Register (41 DR 24551, April 26, 1979), and the completed manual along with the signed documents are expected to be submitted to HQDA in FY 1981. The formal agreements were forwarded to HQDA in August 1980 for Sanford Dam (Lake Meredith). Also, during FY 80, a draft letter of understanding for Sumner Reservoir was submitted to SWD for review and comment. Sumner's water control manual and formal agreements are expected to be completed by the end of FY 1981. Due to the varied approaches between the districts on real time regulation for Section 7 projects a draft policy statement was prepared. It is anticipated that this policy statement will be formalized during 1981.

2. SOUTHWESTERN DIVISION WATER QUALITY PROGRAM AND ACTIVITIES.

a. RESPONSIBILITIES. The RCC is assigned the responsibility to coordinate and direct activities in SWD in the water quality field. This provides for water quality objectives being included as an effective part of our total water management program. Specific activities in the water quality program are as follows:

(1) Conduct technical studies and provide guidance on water quality control.

(2) Review and provide technical assistance in programs for predicting the natural and modified water quality in impoundments, rivers, coastal areas, and estuaries for project planning, design, and regulation activities.

(3) Review and provide technical assistance on project design and reservoir regulation studies in connection with water quality control performed within the division, including multiple level outlet facilities, reservoir simulation studies, reregulation structures, and release reoxygenation systems.

(4) Provide coordination support in interagency liaison as related to water quality control through reservoir regulation, including formulation of operating plans and cooperative data collection programs.

(5) Coordinate with Planning and Construction-Operations Divisions, and the districts, on SWD water quality investigation programs.

(6) In coordination with the Foundations and Materials Branch, manage the water quality investigation activities of the division laboratory.

(7) Responsible for technical engineering solutions to water quality problems in existing projects; reviewing, coordinating, and acting as consultants to other engineering and planning elements in the division office and district offices.

(8) Coordination of division actions required by ER 1130-2-334 for reporting of water quality management of Corps projects.

b. ORGANIZATION.

(1) Division. Water quality activities in SWD are coordinated by the RCC. These duties require the part-time efforts of three engineers. One of these, Mr. Charles Sullivan, Chief, RCC, is a member of the OCE Committee on Water Quality.

(2) Districts. Presently the organizations for water quality management vary within the districts. In all of the districts, water quality associated with planning and design of the projects is coordinated by organizational elements within the Engineering Division, Planning Branch, Environmental Resources, etc. In two of the districts the monitoring and reporting

specifically required by ER 1130-2-334 and that required for dredging and other construction are done by the Construction and Operations Divisions.

(3) Laboratory. The division laboratory is fully staffed and equipped to conduct the tests of water usually required by the districts for use in planning, design, construction, and operation of the projects.

c. SPECIAL ACTIVITIES IN FY-80.

(1) Specific Project Problems. Water quality related problems and activities at individual projects are discussed in the district reports. Some of the more significant of these are summarized below:

(a) Table Rock Dam DO Problem. The comprehensive investigation of the socioeconomic effect of varying levels of dissolved oxygen by the Missouri Department of Conservation under contract with the Little Rock District has continued. An alternative solution study is presently underway to determine the most economically feasible solution to the problem.

(b) Norfork Units 3 & 4 Feasibility Study. An essential part of this study is an evaluation of the water quality impacts of proposed pumpback units and afterbay on Norfork Lake and on the White River trout fishery. A review of this study to date is included in the minutes of the Annual Water Quality Meeting.

(c) Denison Dam (Lake Texoma). Studies were conducted to evaluate various regulation procedures designed to provide (1) quick response to potential fish kills and (2) long term regulation procedures which would enhance the downstream fishery.

(d) Sam Rayburn Dam. Tests to determine dissolved oxygen levels in the releases have been completed and two methods of improving the DO levels are being investigated (1) construction of a skimming wier and (2) deflector plate aeration method.

(2) Instream Flow Problems and Needs Evaluation. EC 1110-2-214 The districts and division completed evaluation of most SWD reservoir projects as required by the EC. A description of the program within SWD is included in Part I, paragraph 6 of this report and in Part III. Detailed project evaluations are contained in Part III of this report. Monthly flow duration and frequency curves for those projects where data was available is in the appendix A to Part III. Annual flow duration and frequency curves are included with the text portion in Part III.

(3) Minimum Flows. SWD's minimum flow studies continued into 1980. Fort Worth District worked with the US Fish and Wildlife Service to determine minimum flows for Benbrook Lake. Proposed minimum flow studies of other projects are included in the Instream Flow Problems and Needs Evaluation in paragraph 6.

(4) Water Quality Meeting. A two-day meeting was held in the Division office on water quality subjects. The meeting was organized by the RCC and attended by personnel from planning, design, and operations of the districts and division. It is considered that this resulted in a great increase in the interest and knowledge of all concerned on the broad aspects of water quality and its influence on the environment throughout the division. A detailed report on the meeting is included as Add. No. 2.

d. LONG-TERM GOALS. The following are presently considered as long-term, continous goals of this division, and consequently the RCC, in the water quality field.

(1) To obtain sufficient water quality information from all of our projects to determine whether all state standards and environmental objectives can be met without adverse impact on authorized uses.

(2) To promote the organization of effective water quality elements in the divisions and districts to obtain the maximum coordination for handling all water quality matters in the division.

(3) Provide helpful and thorough guidance to the districts on water quality matters.

e. IMMEDIATE GOALS. The following actions have been scheduled for accomplishment by the RCC in the near future:

(1) The SWDR 1130-2-9, Water Monitoring at Bathing Beaches, will be revised to provide more specific instructions on bacteriological sample collecting, transporting, and testing. Current applicable state and federal criteria will be discussed, plus guidance on which to conform, in case of disagreement.

(2) An SWDR will be prepared to establish specific objectives and procedures for conducting the water quality management activities at existing SWD lakes. This will establish the division policy, outline monitoring requirements, water level discharge management, and budgeting and funding methods. A draft of the regulation was presented at the Annual Water Quality Meeting.

(3) An SWD supplement to ER 1130-2-415, Water Quality Data Collection, Interpretation, and Application Activities, will be prepared to provide more precise guidance on monitoring and data collection requirements for our operating projects. This will include instructions for coordination with the division laboratory and its role in the program and the use of other governmental and commercial organizations.

(4) An SWD supplement to ER 1130-2-334, Reporting of Water Quality Management Activities at Corps Civil Works Projects, will be issued to clarify and simplify the reporting required by this ER.

(5) An SWD supplement to ER 1110-2-1402, Hydrological Investigation Requirements for Water Quality Control, will be issued. This supplement will provide additional detailed guidance on the following items:

(a) Data necessary for determination of outlet designs for quality control, inflow and discharge quantities and frequencies, downstream requirements for temperature, and objectives.

(b) Instructions on how and where to present the data in planning and design documents.

(c) Data needed for advance planning for monitoring the water quality after construction of the project.

(d) Guidance on what specific water characteristics need to be measured and the utilization of the division laboratory in the studies.

(6) An SWDR will be issued to provide detailed guidance on the selection of outlet works in connection with water quality management. This will cover the number and capacities of multi-level intakes, the number and spacing of inlet ports, operating mechanisms, and installed equipment for monitoring. Modification of existing structures as well as design of new projects will be addressed.

(7) The SWD Guide for Preparing Water Control Manuals will be revised to include more details in the water quality management sections; means available for providing downstream releases to sustain a live stream, instructions for selection of the levels from which withdrawals are made, and the preparation of realistic operation instructions pertaining to specifying rates of changes of discharge quantities and temperatures.

3. SWD SEDIMENT PROGRAM AND ACTIVITIES.

a. During FY 80 four surveys were completed, two each for the Albuquerque and Fort Worth Districts, with assistance from the Tulsa District using their hydrographic equipment and boat.

b. The Tulsa District is implementing a plan using "pole monumenting" to conduct their sediment surveys. This plan calls for using their boat to conduct the survey while the lake is in flood operation. The portion of the ranges above the conservation pool will be surveyed by boat thereby eliminating the land survey. This should result in considerable monetary savings for each survey.

c. The division reviewed and approved design memoranda (sedimentation and degradation ranges) for Aquilla and Candy Lakes. Also, the resurvey results for Cochiti Lake, Eng Form 1787, were approved.

4. DATA COLLECTION AND MANAGEMENT.

a. Stream Gaging Program. Much of the information required for regulation investigation and design of our water resources projects results from the reporting and measurement of flow, water quality, and sediment provided by a Cooperative Stream Gaging Program within the division. During FY 1980 the cooperative program included 517 stations, an additional 75 were operated independently by the Corps of Engineers. The gaging program in SWD cost $1.6 million in FY 1980 with $1.3 million of this being transferred to the USGS for operation of stations. The following tabulation shows a breakdown of the program by class of funds used to finance the program.

| Class of funds | Number of Stations | C of E Cost ($1,000) |
|---|---|---|
| Survey Investigation | 5 | 17 |
| General Coverage | 54 | 29 |
| Planning | 11 | 72 |
| Operation & Maintenance | 408 | 1,282 |
| New work & construction | 40 | 211 |
| TOTAL: | 518* | 1,611 |

NOTE: * Some stations are counted under more than one classification.

b. Cooperative Reporting Networks. The National Weather Service (NWS) and the Corps of Engineers began their 43rd year of cooperation in establishing and operating networks of river and/or rainfall reporting stations in FY 1980. Reports from these stations supplement those from stations maintained by the Weather Service and are made available to the Corps of Engineers for flood control operations and flood forecasting.

Data from these networks are transmitted to the Corps of Engineers district and division offices via telephone and teletype service from the NWS collection office. SWDO maintains teletype drops on three circuits which carry data from these networks. One of the teletypewriters receives the Federal Aviation Administration Circuit (Service C) which provides meterologic data, river stage information and basic public weather forecasts. The other two teletypewriters receive two circuits of the NWS RAWARC network. These two circuits carry radar, hydrological reports, and other data essential to our water control management functions. These data include detailed precipitation reports, river stage information, warnings and descriptions of severe storms and floods, and river forecasts developed by the NWS.

The estimated FY 1980 cost for SWD responsibilities in supporting 611 rainfall stations in the Cooperative Reporting Networks was $165,000.

c. Current Monitoring System. The SWD continued to utilize the services of a commercial time-share computer service (United Computing Systems) until 1 November 1980 for daily computations required by the reservoir regulation personnel. During November this work was transferred to the Honeywell Computer in the Southwestern Division office. Small

desk-top minicomputers have also been used to assist in polling data from about 70 stations in two districts. However, a major portion of the data which are collected and processed daily for reservoir regulation involves manual manipulation at some point in its use. Efforts are being continued to develop automated collection and processing of these data as described in the following paragraphs.

d. Water Control Automated Data System.

(1) The "Water Control Data System Master Plan" for SWD, dated April 1979 was approved by the Office, Chief of Engineers in June 1979 for funding and detailed design. The major components of the system consist of:

(a) Remote Gaging Stations. The plan includes about 100 lake gages and between 200 and 350 river gages that are to be equipped with data collection platforms (DCP) by the end of FY 1984.

(b) Communication. The DCP's will transmit the remote gaging station data over the Geostationary Orbiting Environmental Satellite (GOES) System. Communication between the district and division data processing units will be via leased telephone line.

(c) Data Acquisition and Processing Equipment. The distributed processing system dedicated to water control activities will contain mini-computers located at each district and the division office. They will also be compatible in order to allow for the use of common software and data exchange between offices. The data bases at each district office will be available to the division office.

(d) Data Display and Distribution. Data will be displayed in individual offices with color graphic CRT's, plotters, and printers. Provisions will be made to distribute and/or exchange data with other cooperators. Examples of data exchange requirements are the Office of Chief of Engineers, Lower Mississippi Valley Division (LMVD), Southwestern Power Administration (SWPA), state and local river authorities or agencies.

(2) During FY 80 the detailed design efforts were continued and 51 DCP's were purchased. Appendixes J and K were prepared for the ADP equipment portion of the system. These were submitted to OCE in June 1980 with a request for approval and Delegation for Procurement Authority (DPA) from the General Services Administration (GSA). Approval for acquisition of the equipment was received from OCE on 29 August 1980. DPA from GSA is expected in the next few weeks. The OCE approval stated "This equipment is approved for acquisition specifically to support the Water Control Data System. The use of any excess time for purposes other than the hydraulic and hydrology analysis or modelings, and reservoir regulation functions described in the Southwestern Division Water Control Data System Master Plan, is not authorized."

(3) Design Memorandums (DM's) are to be prepared for each river basin showing the requirements for the DCP's for the basin. These DM's are to include the reporting needs in the basin, schedule for installation of the DCP's, locations, funding and maintenance plans. DM's for the Trinity and Pecos basins were submitted during FY 80 but have not been approved. Approval for purchase of 51 DCP's in the Fort Worth District in FY 80 was granted based on a preliminary DM. The DM is to be completed prior to installation of these DCP's.

(4) Funding. Authority has been received from the OCE Plant Replacement and Improvement Program (PRIP) manager to advertise the ADPE portion of the system. During FY 80 expenditures from the PRIP fund were $180,000 for DCP's. The budget for data collection equipment as submitted to OCE in the annual report in May is as follows:

| | O & M General (09 Acct) Equip Lease | Plant Revolving Fund (PRIP) | O & M General (30.1 WCDS) Equipment | Construction General |
|---|---|---|---|---|
| FY 1981 | 39.4 | 797.5 | 47.0 | 27.8 |
| FY 1982 | 133.9 | 1165.5 | 9.4 | 28.6 |
| FY 1983 | 168.4 | 862.3 | 94.0 | 13.0 |
| FY 1984 | 168.4 | 481.4 | 9.4 | 0 |
| FY 1985 | 168.4 | 0 | 0 | 46.2 |

The approved PRIP funds for FY 84 were about $460,000.

e. Cooperative Data Bank and Forecasting Activity. During the past year RCC has participated in and encouraged the advancement of programs for automated data collection and interagency cooperation in forecasting activity and data bank utilization. Currently, SWD maintains a data bank on time-share computer for Daily Lake Reports, Daily Power Generation Reports, and Daily River Reports. These data banks are updated daily and the data are maintained until the end of the month then used for monthly summaries. These data, with several district auxiliary programs and data bases, have been used to make forecasts and reports available for exchange as needed between the districts and SWDO. In addition, the data are made available to other users which have a need to be aware of the water control activities on a real-time basis. These users include SWPA, NWS, LMVD, and OCE. SWD has also participated in a program to develop a data base for water control information for the Mississippi River Basin.

SWD districts have participated in storing data in the EPA STORET and USGS WATSTORE data banks. Both of these systems have also been used for retrieving data. The Albuquerque and Little Rock Districts have placed water quality data in the EPA STORET data system and Tulsa District has placed sediment data in the WATSTORE data system.

5. COORDINATION WITH WATER MANAGEMENT INTERESTS.

a. Internal.

(1) The Hydrologic Engineering Section (the other half of the Water Management Branch) furnishes support to RCC by conducting systems studies of reservoir regulation.

(2) The benefits deriving from personal contact with other persons associated with water management activities are well recognized by the RCC. For this reason, special emphasis has been placed on maintaining this personal contact through meetings and workshops sponsored by the districts and the RCC with the marketing agency, project personnel, river basin authorities, other RCC's, the Chief's office, and others.

(3) Future workshops will be needed for establishing criteria and implementation procedures for comprehensive interagency data banks. The new automated data collection and handling equipment being acquired by the Corps and NWS will require extensive coordinating efforts over the next few years.

(4) A meeting of lake regulation personnel of each of the districts and the RCC is held annually at the division Reservoir Control Center for the purpose of discussing timely topics and exchanging information. The agenda and minutes of the meeting held on 19 November 1980 are included as Add. No. 1. The minutes summarize many of the current problems and accomplishments of the division in lake regulation activities.

(5) A meeting sponsored by the Reservoir Control Center (RCC) to discuss water quality subjects involved in planning, design, and operation of civil works, was held in the Southwestern Division (SWD) office on 17-18 December 1980. In attendance were representatives from the districts, division, and OCE. Specialists from other organizations were also present. Minutes of this meeting are included in this report as Add. No. 2.

(6) An annual meeting of hydrologic engineering personnel in the Southwestern Division (SWD) was held in the SWD office on 18 November 1980 to discuss certain items of concern relating to hydrologic and hydraulic studies. Minutes of the meeting are included as Add. No. 3 of this report.

b. Other Agencies.

(1) Arkansas River Basin Coordinating Committee. Member organizations include the Corps of Engineers, SWPA, Federal Energy Regulatory Commission (FERC), SCS, Arkansas Soil and Water Resources, Oklahoma Water Resources Board, and Kansas Water Resources Board, Chairman of the committee is Mr. R. Terry Coomes, Chief, Water Management Branch, SWD, Corps of Engineers. The annual committee meetings provide an opportunity for the Corps to present activities, problems, and proposed solutions regarding regulation of flows on

the Arkansas River for maximum overall benefits. In turn, representatives of the states and other Federal agencies may critique our activities and present their ideas and special operation proposals.

The 16 April 1980 annual meeting of the committee included a review of the 1979 water control activities in the basin. In addition to the review other subjects covered at the meeting included the following topics:

a. Occurance and Effects of PCB Contamination
b. Status and Impacts of PCB at Fort Gibson Lake
c. Instream Flow Activities
d. Report on Oklahoma Comprehensive Water Plan

There were also several other items discussed which were not major topics on the program. In addition to the annual meeting, an annual report on the activities is also prepared and distributed to committee members and other interested individuals. The latest report was "Report on 1979 Activities Arkansas River Basin Coordinating Committee". Minutes of the April 1980 meeting are included in Part II of this report.

(2) Trinity River Basin Water Management Interests Group. In order to provide a means for exchanging ideas and coordinating the interests of local, state, and Federal agencies and private companies in the regulation and development of water resources of the Trinity River Basin, RCC has initiated and sponsored meetings of the Trinity River Basin Water Management Interests Group.

The tenth annual meeting of this group was held on 22 April 1980. Attendance included 35 persons representing the State of Texas, several municipalities, water districts, companies, and agencies of the Federal Government.

Presentations were made by the Corps, the Soil Conservation Service, the Trinity River Authority (TRA), the city of Dallas, the North Central Texas Council of Governments, and the Tarrant County WC&I District. Minutes of the meeting with list of attendees and agenda are included in Part II of this report.

(3) Cooperation with Mississippi Valley Division. The SWD RCC continues its cooperation with MVD and provides observed, as well as forecasted data significant to the water management activities in MVD. Exchange of data within the Mississippi River Basin has been improved by the development of a Data Management System by HEC on Boeing Computer System for critical river stations within the basin. Both forecasted and current data can be retrived for individual division and district use.

(4) Cooperation with Federal Energy Regulatory Commission. The RCC acts as primary liaison for the district and division planning elements in determination of applicable benefits in economic analysis of proposed hydroelectric power development. Periodic formal and informal contact through meetings sponsored by RCC keeps Corps and FERC staff members informed on trends and problems associated with production of hydroelectric power. Various reports

such as headwater benefit determinations which are required by the FERC are coordinated by RCC.

(5) Cooperation with Southwestern Power Administration. The SWPA is an agency of the United States, established in the Department of Energy, to execute the purposes of the Flood Control Act of 1944 with respect to the disposition of the electric power and energy made available from the reservoir projects under control of the Department of the Army in the area comprising all of Arkansas and Louisiana and portions of Missouri, Kansas, Texas, and Oklahoma. The scheduling of releases for hydroelectric power production from the 17 Corps of Engineers projects within SWD has a significant effect on the overall water management activities in the division. Therefore, close cooperation and continous communication between the Corps and SWPA are mandatory.

Specific activities requiring cooperation between SWPA and RCC include determination of financial feasibility for power projects, monthly scheduling of power production, preparation of data for reports to the Federal Energy Regulatory Commission (FERC), and daily coordination of routine data on current conditions, inflow forecasts, and release schedules. The RCC has taken every opportunity to improve and strengthen relations with SWPA through correspondence, regularly scheduled and special meetings providing access to our time-share data systems, and by special studies aimed at improving energy production and scheduling in the SWD power projects.

A comprehensive policy is needed for coordination of project operation and marketing for guidance of the Corps and SWPA. At the direction of the Chief of Engineers, SWD was designated as the central negotiating party to coordinate with LMVD and MRD to "Consummate a mutually acceptable formal agreement and general power release regulation" between the Corps and SWPA. This Memorandum of Understanding was signed by the SWPA and the Corps of Engineers this year. SWPA and SWD are in the process of developing a more detailed operating arrangement to assist in the operations of hydropower projects within SWD.

6. Instream Flow Problems and Needs Evaluation EC 1110-2-214.

The instream flow problems and needs evaluation program established by OCE is in response to President Carter's 12 July 1978 memorandum on "Environmental Quality and Water Resources Management". The EC directs all field operating activities having civil works projects responsibilities to conduct a project evaluation of all existing Corps of Engineers water resources projects. The evaluations will be used to assess the magnitude of existing instream flow related problems and needs, the potential cost necessary to meet the identified needs, the opportunities to enhance instream flows affected to accomplish necessary actions. Criteria for the evaluations are contained in EC 1110-2-214 and with further guidance provided by SWDED-XR letter dated 18 August 1980 (Appendix A).

The Southwestern Division Office established a program in mid 1978 to determine minimum flow requirements for fish and wildlife purposes below Corps projects. Several problem areas were determined. Minimum flows were initiated at several projects as a result of that program. Another result was the initiation of studies of several other projects to determine the need for minimum flow and the magnitude of those flows. The Southwest Division has been working with the US Fish and Wildlife Service in an attempt to arrive at a mutually acceptable solution to these problems within present operational constraints. Some of the quantity information required by the EC had therefore been compiled.

The instream flow evaluation program within Southwestern Division has resulted in the evaluation of 84 of the 93 projects. Those omitted are eight low lift navigation structures on the main stem of the Arkansas River and one on the Arkansas Post Canal. These projects have no apparent water quality or water quantity problems associated with project regulation. Low flows on the main stem of the Arkansas River are controlled by hydropower operations at upstream storage and run of river projects. Release requirements are set at the Dardanelle power station which results in adequate minimum flows downstream except under extreme drought conditions.

The number of projects to be evaluated varied tremendously between districts with Galveston District having only two projects to evaluate while Tulsa District had 44. The amount of detail included also varies from district to district. Little Rock and Fort Worth Districts presented a considerable amount of detail on most projects. Tulsa District, due to the large number of projects, grouped projects according to reservoir size and depth, location and outlet works configuration with generalized descriptions for the water quality portions plus known specific problems for individual projects. Of those evaluated about twenty within SWD were described as having no water quality problems or at least none noted to date. Most of these are low lift locks and dams along the McClellan-Kerr Arkansas River Navigation Project. Others are small flood control and conservation projects that do not stratify or if they do it is a mild stratification that is easily broken up by wind action.

Eight projects are currently being studied as part of larger more comprehensive basin restudies or site specific studies to address known high profile problems. Three site specific studies are at Lake Texoma (Denison Dam), Sam Rayburn Dam and Table Rock Dam. These three have been identified by state agencies as having low dissolved oxygen in their releases. An additional study is proposed for Lake Texoma.

Quantity wise, numerous projects have no or extremely low releases for extended periods of time. In appropriated rights states (Texas and New Mexico) most releases, other than for flood control, are made at the request of compact commissions or other state or local agencies having rights to the stored or inflowing waters. Therefore, in most cases, the Corps has no authority to release conservation water for other uses. Even in other states much of the conservation storage is under contract to local governmental agencies and therefore cannot be used to enhance downstream areas.

Twenty projects were identified as having problems severe enough that the districts recommended studies to determine the extent of the problem and alternative solutions. Seven of these are water quantity problems identified by the US Fish and Wildlife Service. The others are water quality problems generally associated with deep stratified impoundments with low level outlets. They are generally low dissolved oxygen, high temperature in trout fisheries, hydrogen sulfide, iron, manganese or pH. Many other reservoirs screened in this program had similar problems but they are not as severe as those indicated.

Table 1 shows projects where studies are recommended including priorities and funding requirements.

| PROJECT | PRIORITY | FUNDS |
|---|---|---|
| Tenkiller Ferry | 1 | $30,000 |
| Lake Texoma (Denison Dam) | 2 | 50,000 |
| Sommerville | 3 | 50,000 |
| Nimrod | 4 | 35,000 |
| Keystone | 5 | 30,000 |
| Oologah | 6 | 30,000 |
| Wister | 7 | 20,000 |
| Blue Mountain | 8 | 15,000 |
| Eufaula | 9 | 15,000 |
| Broken Bow | 10 | 15,000 |
| Lavon | 11 | 60,000 |
| Bardwell | 12 | 60,000 |
| Navarro Mills | 13 | 55,000 |
| Proctor | 14 | 55,000 |
| Belton | 15 | 50,000 |
| Stillhouse | 16 | 55,000 |
| Clearwater | 17 | 10,000 |
| Hugo | 18 | 15,000 |
| Greers Ferry | 19 | 20,000 |
| Pine Creek | 20 | 15,000 |

The Southwestern Division evaluation process required a large expenditure of resources which due to the time frame involved had to be diverted from other programs. These programs are being rescheduled as quickly as manpower and funding allow. The evaluations are, in some instances, the first comprehensive look at problems encountered at the projects. In some districts personnel from Hydraulics, Planning, Operations and project personnel cooperated in the effort to identify all known problems. We feel that this study evaluation will serve as basis for future work to improve the quality and quantity of releases from SWD projects.

## SECTION III - FACILITIES AND PERSONNEL

1. FACILITIES.

a. Office Space. The RCC occupies space in the Main Tower Building, 1200 Main Street, Dallas, Texas. This space provides for an open-space concept working area, conference room, and a communication equipment room. During February 1981, all SWD personnel that are currently occupying space in the Main Tower Building are expected to be relocated. The new office location will be in the Santa Fe Building, 1114 Commerce Street, Dallas, Texas. The RCC's office space will be essentiality as described above, except that space will be provided for SWD's data acquisition and processing equipment. For more detailed information of the system, see paragraph 4d of Section II.

b. Display Facilities. All of the RCC display equipment used for conferences and for briefing of higher authorities is located in the conference room. This equipment includes a large plexiglass panel map of SWD for plotting precipitation, flood areas, and other information; a triple duty wall display unit containing metal chalkboards, vinyl covered cork boards, and white metal panels adequate for grease pencil or for projection screen; and various projection equipment.

c. Communication Equipment. The communication equipment room provides space for the RCC 30 CPS time-share terminal, and our COPE 1200 terminal which is used for remote batch computer runs requiring large amounts of input and printer output. Within the equipment room is a smaller room with additional sound proofing for housing our three weather teletypewriters and FAX machine. The time-share and COPE terminals are used for access of SWD, Lawrence Berkeley Laboratory at Berkeley, and Boeing computer facilities.

2. PERSONNEL.

a. Staff. The current organization chart for the SWD Water Management Branch is shown in Figure 1. The authorized staff of RCC consists of one supervisory hydraulic engineer, three hydraulic engineers, and one hydrologic engineering technician. The RCC is supported by the Hydrologic Engineering Section in technical studies.

b. Training. The RCC periodically assesses the training needs of its personnel and schedules that training which is required and desirable for maintaining expertise and capability to fulfill its mission. Scheduled training for the immediate future includes various hydrologic and management courses.

Additional training objectives are accomplished through active participation and leadership by RCC personnel in committees such as the Arkansas River Basin Coordinating Committee, the Red and Trinity River Basin Water Management Interests Groups, and the Corps of Engineers Committee on Water Quality.

c. Trend of District Reservoir Regulation Staffing. The number of people in the districts assigned to water control activities has decreased about one-third in the past 10 or 12 years while the number of projects has increased by one-third. This points out the need for continuing study of ways to increase efficiency by automation and other means.

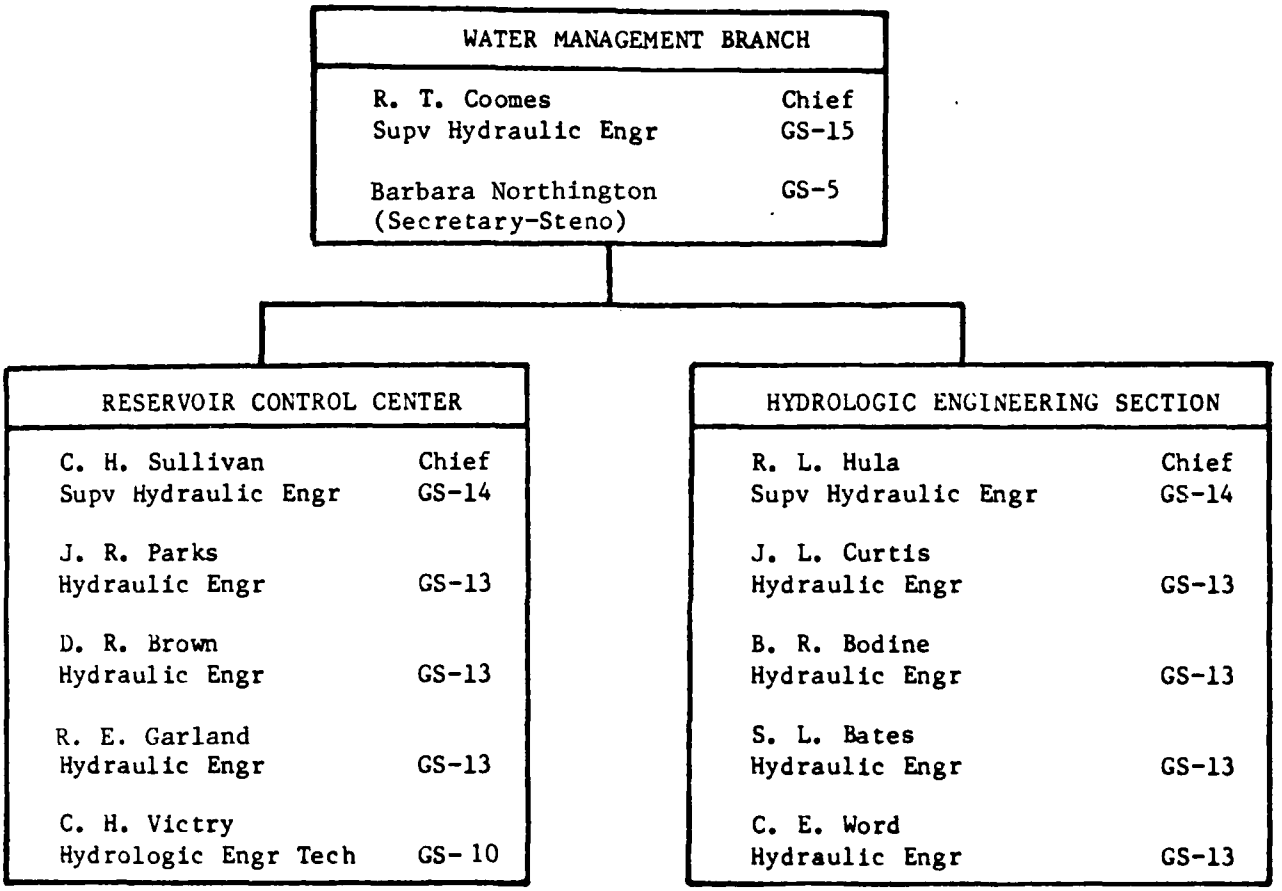

WATER MANAGEMENT BRANCH
R. T. Coomes Chief
Supv Hydraulic Engr GS-15
Barbara Northington GS-5
(Secretary-Steno)
RESERVOIR CONTROL CENTER
C. H. Sullivan Chief
Supv Hydraulic Engr GS-14
J. R. Parks
Hydraulic Engr GS-13
D. R. Brown
Hydraulic Engr GS-13
R. E. Garland
Hydraulic Engr GS-13
C. H. Victry
Hydrologic Engr Tech GS-10
HYDROLOGIC ENGINEERING SECTION
R. L. Hula Chief
Supv Hydraulic Engr GS-14
J. L. Curtis
Hydraulic Engr GS-13
B. R. Bodine
Hydraulic Engr GS-13
S. L. Bates
Hydraulic Engr GS-13
C. E. Word
Hydraulic Engr GS-13

Figure 1

ADDENDUM NO. 1

MINUTES OF RCC ANNUAL MEETING

Minutes
Annual Meeting
Reservoir Control Center
19 November 1980

1. Introduction and Opening Remarks.

a. The 1980 annual meeting of the Southwestern Division Reservoir Control Center (RCC)was held on 19 November 1980 in Dallas, Texas. The meeting was attended by representative(s) of OCE, SWD, and each of the SWD districts. An attendance list and the agenda of the meeting are attached.

b. Mr. Charles Sullivan, Chief of the RCC chaired the meeting. He began the meeting by summarizing last years meeting agenda and significant events. He reemphasized the importance of developing the best regulation plan, plan documentation (water control manuals) and ultimately the plan implementation. He asked that the districts continue to look at their stream gaging programs in order to assure that their programs do not include excess gages to operate the reservoir projects. Also, stressed to particularly take a close look at those stations that are to be automated. Mr. Sullivan stated that the first Annual Water Quality Meeting and continued progress in the development of the division Water Control Data System (WCDS) were indicative of some of last years accomplishments. SWD has justified an additional position to provide assistance to the districts in the development and application of WCDS equipment which is scheduled to be purchased over the next two year period. Opening remarks were concluded with commendations to each district for their accomplishments during the past year.

2. District Status Reports.

a. Albuquerque District. Bob Easley reported that the snowpack in the Rio Grande Basin during 1980 was above normal and exceeded the 1979 snowpack in the upper Chama Basin. However, runoff during the spring was only about 75 percent of the 1979 runoff. Runoff in the Arkansas Basin was also above average but did not cause any lake regulation problems. John Martin retained water in its recreation pool throughout the summer months for the first time since 1965. Mr. Easley summarized their water quality activities by stating what parameters that were sampled and their intervals of measurements for the lakes in the Albuquerque District. The district has purchased a gas cromatograph to test large releases for dissolved nitrogen and will train personnel in equipment operations. For sediment activities he referenced prior discussions with SWD (see Part II of this report). The co-op stream gaging is as about as slim as can be gotten. At the end of Albuquerque's report Mr. Terry Coomes, Chief of the Water Management Branch, queried the district on manpower retention in the areas of water management. Each district expressed their concern for the lack of manpower and a greater concern for retaining experienced personnel in these areas. Specifically the discussions dealt with manpower capability

for lake sediment resurveys. The Albuquerque and Fort Worth Districts have three surveys scheduled for FY 81 and had anticipated that Tulsa District would make the surveys. Mr. Scoggins, Tulsa District, stated that they would be unable to provide personnel to make surveys. The hydrographic equipment could be made available, but using district would need to train personnel to operate equipment. As an alternative, Mr. Scoggins recommended that other districts employ a survey method that is presently being used in the Tulsa District. This method was termed as a "pole survey" which is used to survey selected (index) ranges when the lake level rises into the flood pool. He felt this is an adequate method and would reduce manpower requirements, cost, and time required to perform such surveys. It was suggested that Galveston and Little Rock Districts may have equipment for use by the Albuquerque and Fort Worth. In the meeting, it could not be determined whether such equipment would be available. SWD asked that the Tulsa District review the original arrangements that provided for the Tulsa District to assist in hydrographic surveys for other SWD districts.

b. Galveston District. Jim Kosclski reported that the district had a relatively quiet year without any major flood problems. However, urban areas above reservoir lands are being developed. Development of these lands include channelization which is expected to create a sediment and maintenance problem.

c. Fort Worth District. Mr. Alloju lead the discussion by stating the difficulty in doing sediment computations without the use of an adequate computer program and shortage in manpower. This has been especially true for planning type studies where several reservoir sites with many combinations of conservation and flood storages. Mr. Donaldson stated that no unusual flood control activities occurred during the year but, the following were some significant water control activities:

(1) Lake O' The Pines - Deviations were requested and approved to allow the lower 50 to 25 percent of the flood control storage to be regulated to downstream control points in an attempt to minimize nuisance flooding along the headwaters of Caddo Lake. The approved plan of regulation calls for making a control release of 3,000 cfs when the lake level rises into the flood pool, regardless of flow in the channel reach between Farrells Bridge Dam and Caddo Lake. An analysis of the plan has been made and approved by SWD on an interim basis until further economic evaluations can be made.

(2) Whitney Lake - During the spring of last year, the storage in Whitney was essentially depleted. Whitney hydropower generations were supplemented by generations from Lake Texoma to meet energy needs of the area.

(3) Sam Rayburn and B.A. Steinhagen - The system was operated using an interim plan which provides for an operating scheme that attempts to maximize the use of the conservation storage in Sam Rayburn by considering hydropower, water supply, released flows to keep the salt water from intruding

into the lower Neches, and the installation of temporary saltwater barriers. The interim plan will be used until further refinements to the plan can be analyzed. This analysis is scheduled for completion during February 1981.

(4) Drought Conditions. The district experienced fairly severe drought conditions within the district's river basins and two drought summaries were submitted to SWD.

(5) Other flood activities were discussed by Mr. Jimmy Baggett. Emergency assistance was provided to the City of Roscoe due to local flooding from the remnance of Hurricane Danielle. FWD provided six pumps to the city. The city is located in a playa lake and required 3 to 4 weeks to evacuate the water from the area. The district anticipates that studies under section 205 will be started to investigate the feasibility of a local flood protection project. Mr. Coomes asked if an accounting problem exist during dry periods at those projects that have both present and future water supply. For most projects, accounting is not a problem because all of the storage has been contracted for. Presently the district is working on accounting procedures with local sponsors of the projects. The biggest problem encountered is the interpretation of the water supply contracts. As an example, Belton Lake which has three users (BRA, Temple and Ft. Hood), two contracts exist for Ft. Hood and each reads somewhat different from the other. Aubrey will be another project that will present problems in contract interpretation. Ultimately such procedures may have to be established politically.

d. Tulsa District. Mr. Ross Copley stated that below median flows were experienced throughout the year. However, in October heavy rains produced the flood of record for inflows into Cheney Lake. The pool level reached elevation 1429.2 on 2 November 1980. The previous high pool was 1429.0 that occurred in October 1973. Major flooding occurred in Sedgwick and Halstead on the Little Arkansas River, with minor flooding at Peck on the Ninnescah River. June through September was very dry where inflows only were about 30 percent of median. Diversions were made for El Dorado on 3 October and Big Hill in May. On 26 June all three units at Webbers Fall were taken out of service because of cracked shafts. The units are expected to be out for repair for about two years. There were several minor deviations during the year. Three tapers were run for the navigation system. Flows for these tapers at Van Buren were 62,000 dsf, 70,900 dsf and 81,300 dsf. Due to drought conditions the Kansas Water Resources Board requested that water quality releases be reduced from Toronto, Fall River and Elk City Lakes on the Verdigris River in order to prolong releases. In the Red River Basin, releases at Pine Creek were increased to 10 cfs for water quality problems at Wright City. A special release was made from Waurika at the request of the Oklahoma Water Resources Board. At the time of the request the lake was in the process of filling, therefore these were the first releases made for downstream water quality purposes. Also, special test releases from Denison were made for distressed fish. The flood of May which occurred on Otter Creek filled the conservation pool at Mountain Fork for the first time since 1975 and utilized 60 percent of the flood control storage.

The estimated design channel capacity of 1,000 cfs was found to range from 300 to 350 cfs while making flood releases. The Arkansas River Master Manual was approved during the year and considerable progress was made on other manuals. For section 7 projects, the Sanford Manual was completed. During the past year a forecasting group was formed in order to provide timely forecast during flood situations. The group will be assigned other duties. These duties will include the development of forecasting chapters for water control manuals and the assistance in developing the automated data collection system.

e. Little Rock District. Little Rock District activities were given by Mr. Bill Issacs, Chief, Hydrologic and Hydraulics Branch. He reported that the most significant event of the year was the boundary change between the Little Rock and Tulsa Districts. The boundary change transferred the responsibility of the Little River system of lakes (DeQueen, Gillham, Dierks, and Millwood) from Tulsa to Little Rock on 1 October 1980. The district experienced the same drought conditions that some of the other districts had. The rainfall was about 10 to 20 inches below normal and inflows averaged about 30 to 70 percent of average yearly volumes. There were no significant rises in the flood pools of the larger projects however, minor rises did occur in some of the smaller projects. One of the biggest impacts on on power pools during July and late August was due to large energy demands because of extreme high temperatures. These heavy demands resulted in the pools being drawn down faster then desirable. However, later in the year generation from Corps lakes were reduced due to cooler temperatures and the SWPA's purchase of energy from non-hydropower sources. The following summarize special operations and other district activities that occurred during the past year.

(1) Table Rock - In anticipation of continuing low DO problems, a deviation from the plan of regulation was implemented to operate Table Rock to generate more power early in the season in order to pull it down. The painting of gates on Table Rock was started during low pool conditions that existed in July and August and painting is expected to be completed early in FY 81. It is anticipated that the gates on Beaver will be painted during the present low pool conditions.

(2) Greers Ferry - In April there was a minor rise into the flood pool. The flood storage was evacuated by making firm power.

(3) Clearwater - We delayed the evacuation of the seasonal pool to its winter time level by 30 days (15 September to 15 October) to allow the Arkansas Game and Fish Commission to complete some work in parts of Black River Game Refuge.

(4) Nimrod - In September 1979 the lake level was lowered to permit Plainview, Arkansas to do some structural repair on the water supply intake and repairs were completed in October 1980.

(5) Deviations:

(a) Blue Mountain - During last spring, sustained releases were made at several different levels for gathering field data at points where flooding complaints had been received. Also, data would be used for updating regulation procedures and eventually revisions to the water control manuals.

(b) Arkansas River - The pools were raised on several occasions to protect some minor shoaling until they could be dredged out. Also, raised two of the pools to open drainage structures to allow drainage back into the tributaries for irrigation purposes.

(6) Special studies - (a) The White River Basin studies were continued and are scheduled for completion in April 1983. (b) The dam break analyses were continued in connection with the flood emergancy plans. The results of these analyses will be incorporated into Chapter 9 of each respective O&M manual. To date, the analyses of Greers Ferry is complete, 80 percent complete on Clearwater, 70 percent on Beaver and Table Rock. The above completion percentages are subject to change pending receipt of additional SWD guidance. The analyses for all other projects are on schedule except for Blue Mountain. Studies will begin for Blue Mountain upon completion of previously mentioned studies.

(7) Sediment Programs - The district has had no problems in getting money for ranges that are scheduled for survey. As other districts, the problem encountered was the loss of personnel to do the work. Presently limited capability is being rebuilt for the purpose of obtaining bed load samples. The USGS takes suspended samples at 10 stations along the Arkansas River. However, the districts main operation is the surveying of 247 sediment ranges on the main stem of the Arkansas River which are resurveyed on an as needed basis. Last fiscal year there were 166 of these ranges scheduled for resurvey with an actual survey of 162. The district has 143 ranges scheduled for resurvey in FY 81. Fifty-four tributary ranges were resurveyed within the last 1 to 2 weeks. A similar program exists for the 350 sediment ranges for the eight major lakes. About fifty of these habe been established as index ranges and are scheduled for resurvey on about a ten year interval. None were resurveyed last year and none scheduled for FY 81. The Waterways Experiment Station (WES) developed software for use on the district's Tektronix equipment. These programs will allow for rapid data retreival and data update and thereby elminating a backlog of sediment surveys. Also these programs are to be used for future sediment range surveys in the district.

(8) Cooperative Stream Gaging Program - There were no significant changes made in the program during the past year. The district will take a closer look at its program for next year in view of what Mr. Sullivan had stated at the start of the meeting.

3. Water Control Data System.

a. Mr. Parks led the discussion by summarizing the history and procedures for developing the system. In 1978 we received a directive from OCE directing us to prepare a master plan for a Water Control System which would involve field equipment, how data would be handled when bringing it into water managers, processing of data, distribution, and use of data. As requested by the OCE directive, the SWD prepared a master plan and submitted the plan to OCE in the spring of 1979, The system concept, as approved, is a "Distributive Processing System" which will provide data processing capability for SWD and each district office, will allow for transfer of data to external users such as neighboring divisions, SWPA, state and local agencies for whom we deal with on a day-to-day basis.

b. Past Years Activities - During the past year appendices J & K were prepared for the ADP portion of the system. The documents provided the justification for the ADP portion of the system and the preliminary solicitation documents (PSD). The PSD had to be prepared and forwarded to the ADP section of OCE for approval and then over to GSA for delegation of procurement authority. This document has been approved by the Chief's office and GSA has also approved procurement and has returned the document to OCE. We have received a letter from OCE stating that we should finalize our solicitation document and they will hold the procurement authority until the document has been finalized. Mr. Parks emphasized specific wording of the authorization document. The document states that the system will be used strictly for water data control activities and should not be used for studies for sediment or other type activities. The authorization states "this equipment is approved for acquisition specifically to support the Water Control Data System". Recognizing that there will be times when the system will not be busy. Even if that is the case, the system should not be used for anything other than for its authorized purpose. The system was designed for a worst flood situation and that capability should always be available. Mr. Parks discussed the complexity of the system by showing a diagram (Attachment No. 3) indicating the components of the system. He discussed each component and gave a progress report of each. During this discussion, he recognized the effort by the districts in the system development and document preparations.

c. Budgeting - Attachment No. 4 describes the WCDS cost estimates. Mr. Parks stated that these estimates could be helpful in budget preparation and should be realized that actual cost could be different. The estimated cost for the purchase of ADPE is about 1.25 million dollars and is being included into the PRIP fund. In the past, ADPE and generalized equipment have been under separate categories. This year ADP PRIP and other PRIP is under one category. Therefore, you are competing with all items in that category. A positive point of this change is that it will be easier to keep up with one budget. The negative aspect is that ADP is in the general PRIP and is not protected anymore. The initial submission for FY 81 PRIP funds

was $798,000. This amount is for the ADP portion and some field stations. The PRIP allocation when returned from OCE was essentially the same as submitted. After review by the SWD PRIP manager, it was determined that Water Management's portion was too much when compared to the total allocation. Therefore, the water management PRIP was reduced to $461,000. With the reduction in PRIP, a decision had to be made as to what could be accomplished with the reduced amount of funds. It was decided that the Tulsa District and the Southwestern Division systems would be installed in FY 81. The cost of these systems is approximately $460,000 which is essentially equivalent to the amount received. This will delay some gage installations that were primarily scheduled for the Fort Worth District. Hopefully some surplus funds will become available during FY 81, generally the case, which could be used for gage purchases. Additional fund scheduling: FY 82 - $1,267,000, FY 83 - $800,000 and FY 84 - $500,000. These amounts will have to be approved for each current year. In connection with the fund scheduling, is the contract for ADPE purchase. The ADPE purchase contract will be one contract extending over a 2 year period which means contracting across two fiscal years. We have been given the authority by OCE to issue the continuing contract. The remainder of the system will be budgeted for in FY 82 and will be one of the top items in the budget. However, there is one stipulation in awarding the contract, OCE wants to see the summary of bids prior to award. Mr. Parks asked that each district consider their annual costs in their budget preparation. He stated that these cost will be a "healthy" part of their O&M funds and discussed the various items of the total annual costs.

d. Delivery of ADPE - Attachment No. 5 shows a tenative delivery schedule. After the first unit has been installed, it can be expected that the delivery cycle will be about a 30 to 90 day acceptance period which will allow for the system to be checked out, to include contract compliance. Mr. Parks stressed the importance of ADPE facilities. He feels that these facilities should be ready at least 30 days in advance of the scheduled delivery of equipment. The districts requested that a letter be sent out to each district emphasizing the importance of getting their facilities ready for receiving the ADPE. It was felt some decision makers did not realize the importance of expediting facilities preparation. The tendency is to see this as a long range activity. Also felt that such a letter would be important in assisting district water management personnel in briefing new district engineers and other new managers. Some districts expressed a concern for not having available space in the water management areas to accept the equipment. During the course of this discussion it was recommended that, if possible, a visit be made to the Nashville District. Nashville has a very impreseive set-up and they have progressed to the point where they have several programs working. Such a visit by district Chiefs of Engineering and District Engineers was recommended.

e. Interface with AFOS - NWS is only allowing one entry port per division. The Corps feels that this is unsatisfactory because of several reasons and time will not permit us to discuss each of them. At this point,

it is not known how this problem can be resolved. We are designing our system without the interface tap. The conversion of AFOS data will cost about $200,000 including the software and hardware. If the NWS only allows one port, the data will have to be brought into one point and then the data will have to be distributed. This procedure does not provide the necessary back-up capabilities. What appears not to be realized by the NWS is that if a failure of data exchange were to occur, this would not only wreck the Corps operations, but would destroy theirs as well. As an example, the SWD has approximately 500 cooperative reporting rainfall stations that report to the NWS. If all of these stations were to only report to the Corps system, this could cause some problems for the NWS in making their forecasts. Presently OCE is in the process of preparing a letter of understanding which considers only one port. Mr. Parks stated that maybe during the process of the NWS implementing the system, over the next 1 to 2 years, this problem will be resolved. The schedule for AFOS should allow the RAWACS machines to remain available until about 1982.

f. Software Development - This is one of the areas where we have not had the manpower capability to look at the development of software. Consequently this is one area that lags behind the rest of the system development. In order for SWD's system to operate as a system, it will be necessary to have a manager to oversee the entire system software development. The majority of all software should be common to each district. There should be a commonality in such things as forecasting procedures and communications so that they can be easily transportable to each machine within the SWD system. However, it is recognized that there will have to be some special software development for a particular district need and this is permissible. Mr. Parks cautioned against program development without proper documentation. It not properly coded the programs can become useless. Attachment No. 6 gives a projected cost for software development. The projected cost of software development is about $1.5 million. Presently we only have the capability to handle about $200,000 to $300,000 of development per year. Therefore, software development is going to be a long process and will include some contracting of work. Experience gained in NPD has shown that it is not desirable to completely have all software developed through contract for reasons such as limited capability to modify and update programs as required.

g. Training - In order to run this system it is going to require training of personnel. With the distributed system, there will be a great deal of responsibility at the district level. Attachment No. 7 suggests a minimum number of personnel and effort that will be required by each district to keep the system operating. The operators concern on this system is going to be different from those that we are accustomed to in using the time sharing system. In running this system we will have to concern ourselves with such things as tapes, keeping discs updated, reloading of discs, bringing the system up if it shuts off or crashes. If system problems occur we will need someone who is able to trace the problems through the system rather than calling the telephone company or ADP personnel. There will also be requirements for system management which will include:

(1) Records keeping
(2) Overseeing tape library
(3) Setting priorities
(4) Identifying outside users
(5) Security of system
(6) Additional knowledge by those who have previous experience with other systems but lack knowledge of characteristics of this system.

Mr. Parks did not venture a guess as to what the total requirements would be for system users. These requirements will be dependent upon the interface of man with machine. It is realized that there are some basic requirements for the user such as learning system commands for signing on and off the system.

h. Field Equipment - Prior to Mr. Donaldson's discussion on the Fort Worth District's progress in this area, Mr. Parks reemphasized the importance of preparing the design memos for the installation of field equipment. During the past year, there were some request for purchasing of equipment without and approved DM. Therefore, the SWD had to provide an approval for purchase based on a partial DM. This is not considered to be a desirable method. The best method is to prepare the DM's and get them approved prior to request of approval for purchase of equipment. At this point no district has a complete approved document. Mr. Donaldson stated that for FY 80, the FWD had money in the budget to purchase approximately 30 platforms to be purchased by the end of the year. However, the district received additional funds that could be used for the purchase of additional platforms. The additional funds allowed FWD to purchase a total of 52 complete platform sites during FY 80. Equipment at those sites included the platforms, atenna, batteries, solar panels and other equipment required at the site. The equipment purchased for these sites are Handar. Mr. Donaldson stated that they had only encountered one problem. The problem is that OCE has not provided channel assignments, ID's, and time slots. The Handar unit has two channels one for emergency transmission for which OCE is not prepared to accept request for assignments to use the channel. We are currently working with OCE so that we may receive assignments for the use of those channels. Additional activities in FWD were:

(1) The completion of an agreement with one of the river authorities for use of DARDCS. These will be utilized in those areas where proper maintenance can be provided and where DCP's are not considered necessary.

(2) The agreement of USGS to install 30 stations in Texas through their contract with the Comsat General. With these stations, the FWD will probably have approximately 100 sites that are automated within the next 12 months.

Mr. Donaldson recommends that test equipment be considered in budget estimates. FWD has found that there will be some minor problems that will occur with equipment and these problems can be resolved with a minimum amount of test equipment. Tests and repairs can be made by district personnel. For major problems, the equipment should be returned to the manufacturer. The district

has a list of test equipment that has been purchased and this list can be made available to other districts. Storage space could become a problem if several platforms are purchased at the same time. Therefore, temporary storage should be considered until platforms can be installed. Mr. Donaldson restated that the equipment purchased by FWD is manufactured by Handar and he feels this is the best equipment available at this time. LaBarge has redesigned their DCP's and expect to have their equipment available on or about the first of FY 81. Their redesigned DCP's are expected to be essentially the same as Handar's. However, there will be some software difference. Also during the past year Sutron was able to get their equipment certified and presently no literature is available. FWD is not sure whether their equipment will be considered for purchase. Even though the majority of equipment purchased to date was manufactured by Handar, this will not preclude using other types of DCP's. The field equipment is modular with the antenna and other platform equipment being the same. If more desirable platforms become available, then these can be simply plugged in. Mr. Donaldson mentioned that when budgeting for purchasing the DCP's, it should be recognized that all associated equipment with the DCP's will not come from PRIP funds. An SWD letter was sent to all F&A offices in May 1980 stating that those items less than $1,000 will not be purchased with PRIP funds. In effect, the only item purchased from PRIP funds for the DCP's are the cans. All other items will bought from revolving funds. These items would include atenna, batteries, solar panels, and other equipment that cost less than $1,000. This could mean that at the end of the year you could end up with surplus PRIP money that was initially budgeted for the DCP's. Presently the district has one platform in operation. Others will be installed when channel assignments are received from OCE. The DCP in operation has been working successfully since the spring of last year and on one occasion the emergency channel went into operation. The emergency channel transmitted for about six hours without any problems. At this point, Mr. Donaldson expressed a concern for not being able to receive data from the National Environmental Satellite Services (NESS). He was optimistic that transmission of data would be improved when NESS completes their changes to their down-link. Also recommended that each district should have its own receive site and feels that cost would not be prohibitive. To assist FWD in installing their DCP's, FWD had Handar to come to the district office to provide training on installation and operation of the equipment. The USGS was also in attendance. Mr. Donaldson stated that the equipment is very easy to install. Mr. Coomes asked why consideration is being given to installing several different brands of DCP's. Mr. Donaldson stated that this not something to plan for, but certainly should be considered if better and more reliable equipment becomes available on the market. This would be especially true if plans were to make additional purchases. However, caution should be taken to assure that sufficient spare parts would be available for maintenance of the system. For software developments or modification presently the Handar DCP's are designed to accept new chips if software changes. He anticipates that this feature will be included on other brands. The concensus of the group was that such a mix would not cause an undue maintenance problems but would provide the opportunity for upgrading the system. Mr. Donaldson stated that the district is awaiting the results

of the program between the USGS and Comstat General for possible assistance in developing their maintenance program. He recommends that a similar type program be adopted by the district. Such a program allows for all maintenance to be done by one contractor in lieu of several contractors which should result in more efficient operation. He has had several firms to inquire about the possibility of contracting for the district's program. The maintenance of system could possibly be done through contracts with retired USGS employees. The district is also hopeful that maintenance of the system could be included into existing cooperative programs between the Corps and the USGS providing that the cost is not prohibitive. The USGS has expressed that they have the capability to maintain the system.

4. Status of System Regulation Studies. Mr. Sullivan led the discussion by stating that SWD had received some request from the districts for additional help in system development. Therefore, Mr. Clinton Word will discuss the status of studies that are currently being done by SWD and then the needs of the districts can be discussed. Mr. Word gave the following status report:

a. Arkansas River Basin. The basin study contains 35 years of record in the data base (1940-1974) with 28 reservoirs, 38 control points and the model extends down to Little Rock. The study also contains good economic data. During the past year there were no runs made except for some runs for HEC. Data from these runs have been supplied to some A-E firms in connection with the hydropower studies and data also have been supplied to the Tulsa District.

b. Trinity River Basin. The Trinity data base contains 30 years of records (1940-1969). The Fort Worth District is interested in updating the data base, since there is an additional 10 years of record. The model contains 15 reservoirs, 29 control points and extends down to the Romayor gage. Presently, the model contains no economic data but will be needed for studies and will take a considerable amount of effort.

c. Colorado River Basin. The Colorado River Basin model data base contains 45 years of record (1930-1974), 13 reservoirs, 25 control points, and the model also contains fairly good economic data. The last control point in the model is the Bay City gage on the main stem of the Colorado.

d. White River Basin. This system has been taken over by the Little Rock District and during the past year SWD has not expended much effort on this study except for support. The system data base contains 35 years of record, 7 reservoirs, 18 control points, and good economic data. The economic data is probably the most detailed, at this point, of any of the other basin studies. The model extends down to Clarendon. The program has been changed to allow for the use of more than 1 year rule curve which is presently being used in the other systems. Presently the Little Rock District is considering extending the curve to 4 years for the purpose of making fish and wildlife studies.

e. Red River Basin. The system has 39 years of record, 21 reservoirs, 32 control points and extends to Alexandria, La. Presently, the model contains economic data down to Fulton but the data have not been checked.

Over the past year SWD has expended considerable effort in transferring data to all of the districts for the purpose of preparing data bases. In order to make this a more efficient process, the super program's utility routines are being modified so that they will be fairly universal and self explanatory. Additional program documentations have been made which will allow the district to do their own data base manipulations. In the past, there have been some problems due to the lack of clear communications and the amount of time required in the transfer of data. These updates should be completed by the first of the calendar year.

Mr. Word encourged districts to make all studies using the Berkley system. When large data bases are transferred between systems, there is a great deal of time that is lost. If data are missed on the first time and a reorder is required, this process could take as long as three weeks. At the end of the discussion, the district personnel were queried as to additional studies that are in progress that would require support from SWD. The Fort Worth District expressed an interest in support on the update (economics) of the Trinity River Basin and model development for the Brazos River Basin. Tulsa expressed a need for an update of the Arkansas River system by adding 4 or 5 reservoirs to the system. However, this will probably not be needed until the next 2 or 3 years. Mr. Sullivan emphasized that SWD's efforts for the coming year had been committed to the Red River system and would only be able to provide limited support for other systems.

5. Proposed Guidance on Section 7 Projects Within SWD. Mr. Sullivan began the discussion by going through the major points of the draft guidance issued by SWD in a M/L letter dated 1 October 1980. District personnel had mixed reactions to proposed guidance. However, the following items were concurred in:

a. The project owner should pay for the collection of data for operation of the project.

b. Turn the real-time operation of projects back to the owner unless the operation of the project will impact the operation of Corps projects.

c. The owner should operate the project if it does not impact a Corps lake. If the owner wants the Corps to operate the project then required funds will have to be negotiated. That is if we have sufficient manpower to handle the operation.

d. The Corps will assume the cost of data collection if we operate the project. The owner should assume this cost if they are providing the real-time operation.

e. The Corps will assume the cost of preparation of the initial water control manual. Also if future updates or changes are required due to changes in channels, etc. the cost of studies and a manual update will be assumed by the Corps.

To date we have had a response from two of the owners of Section 7 projects and basically there were no objections. However, they asked for more detail on the proposals. When draft guidance is being finalized, SWD's opinion is that policy should be approached, generally, in the same manner as presented in SWD's multiple letter. Also, travel times are not expected to be discussed in the final guidance.

6. District Water Quality Activities.

a. Albuquerque District. Bob Easley reported that samples are being taken at monthly intervals for all reservoirs that have water stored. Samples are taken at two locations in all projects except for John Martin and Conchas. At these projects samples are taken at three locations. Presently samples that are taken are pH, turbidity, DO, and temperature profiles. However, for this year plans are to begin biological testing for bacteria at all projects and these samples will probably be taken on a monthly basis. All samples are taken in the reservoir and none are taken by the Corps downstream of the projects. The Operations Division plans to start an extensive program in cooperation with the Fish and Wildlife Service to take samples downstream of the projects. The USGS does have a base program which include taking some downstream water quality samples at certain projects within the district. These samples are taken in conjunction with the lake profiles whereby samples are DO and temperature of the outfall.

b. Galveston District. Last year there were no funds in the budget for water quality. Therefore, no samples were taken. Mr. Kosclski stated, for this year, that funds are available and the three year sampling program would be continued.

c. Little Rock District. Mr. Larry McGrew reported that last years water quality activities were essentially the same as have been in the past. This year the district is expanding its monthly profiling from five lakes to eight lakes. Also starting in April 1981 the district will begin to take samples from those lakes that were transferred from the Tulsa District. There will be some limited special sampling of those lakes that have been identified to have problems with sulfides in some of the smaller lakes. Presently most of the district's water quality resources are working on special studies at some of the existing projects, these include:

(1) Table Rock DO studies that have been under investigation for some time. Presently we are monitoring Beaver Lake releases to determine their affect on Table Rock as they pass through the lake.

(2) Greers Ferry - An environmental protection study which is a 208 type water quality management study.

(3) Norfork - Two additional pumpback units are being investigated which requires some detailed modeling to determine their affect on water quality in both the lake and downstream in the White River.

(4) White River System - This study includes a more detailed water quality analysis than was considered in the SWD White River temperature model.

(5) Future studies - Funds will be available in the FY 81 budget to allow for some additional studies in the area of instream flow needs.

d. Fort Worth District. Mr. Alloju reported that the district's water quality activities have been expanded from eight to seventeen projects. Samples are taken at various stations on each of the lakes including monitoring at one tributary station and one reservoir outflow station. Samples will be taken three times a year by the USGS personnel under the cooperative program with the Fort Worth District. Monitoring includes physical, chemical and biological quality determinations. In addition to the above sampling, monthly dissolved oxygen and temperature profiles are collected by the project personnel at each of the existing projects. Investigations are continued at Sam Rayburn Reservoir in connection with the low DO that exist. The objective of the study is to determine if and how the DO can be increased through investigation of alternative methods such as skimming weir, etc. In addition to a skimming weir, the district is currently investigating the feasibility of using the deflector plate aeration method which has been successfully installed in the Alabama Power Company Hydroelectric Projects. These are: the Bankhead, Holt, Logan, Martin and Martin Hydroelectric Projects. The deflector plate aeration method involves producing locally negative pressures in the draft tube by utilizing deflector plates attached to the draft tube. The deflector plate causes the flow to separate from the draft tube wall in the wake of the deflector plate and produces pressure in the wake region lower than the free stream static pressure. Venting the low pressure region to the atmosphere results in an aspiration flow into the draft tube. This method of turbine aeration is inexpensive. This method is good when an increase in DO is less than 2 mg/l. Upon completion of Mr. Alloju's discussion on the deflector plate aeration method, he asked the group if anyone had any experience in using this method. In response to this question, Mr. Earl Eiker (OCE) affirmed that this method has been used at projects in the Alabama Power Company. Also, TVA is trying some new approaches which they anticipate will allow gains in DO up to 4mg/l. They are having some difficulties due to the decrease of efficiency on the power pool which ranges from 2 to 3 percent. So from this, you can see that this method is actively being investigated.

e. Tulsa District. Mr. Tom Horner reported on the Tulsa District's water quality activities. During the past year there were eight base line studies and the data collected consisted of organic, heavy metals in waters and

fish flesh, and a multitude of general parameters such as physical, general, and biological. For next year it is anticipated that at least three base line studies will develop. A student at Oklahoma State University who is doing doctoral work in the area of lake destratification is collecting data at Pine Creek and Texoma Lake. A great deal of information on lake destratification has been gained. At this time, no specific results are available. In addition to the previously mentioned activities, we continued our cooperation with WES and the US Fish and Wildlife Service in their Environmental and Water Quality Operational Studies (EWQOS) at Pine Creek and Gilliam Lakes. The major efforts over the past year have been in the area of low DO problems below our hydropower projects. Keystone, Eufaula and Denison have experienced very low dissolved oxygen in their tailraces during high temperatures that occurred this past summer and fall months. As a result of these problems, the following tests were conducted at Denison:

(1) Several releases were made at the rates of about 50 to 100 cfs. These releases were made early in the morning where the DO was expected to be at a minimum in the stream immediately below the project. The DO was measured to be about 1.8 ppm. Denison was operated in this manner over the weekend and the DO increased to 6 ppm. We thought the results were as good as could be expected from a relatively large project. The downstream data were inconsistent in that 300 yards downstream the DO was 4.5 ppm and 2 miles downstream the DO measured 7 to 8 ppm or at the saturation point.

(2) Slug Flow Test - About 100,000 cfs was released and the results in the stilling basin were approximately the same as for the above test. Also, there were no significant increases downstream in the 2 mile range. Therefore, it was concluded that large slug releases are not as beneficial as small releases .

Mr. Brown stated that all of the samples were taken at a single point and monitored continously at about 10 minute intervals and the density of the water from the lake was about the same. Mr. Brown also discussed the correspondence between the SWD and EPA in connection with water quality standards in the States of Oklahoma and New Mexico. Our comments on the standards were that Corps projects should have an area below each project for reoxygenation. EPA's response to our comment, was that we define the reoxygenation area where the state standards may be met. We asked the Albuquerque and Tulsa Districts to provide their comments on EPA's request. Both districts' comments have been received and we have written back to EPA. At least, the regional office of EPA has recognized that dissolved oxygen problems do exist immediately below these projects. Mr. Brown announced that the Annual Water Quality Meeting would be held on 17 and 18 December 1980 and essentially the same people will attend as last year. At the end of this discussion, Mr. Eiker was asked what is the policy on placing a hazardous waste fill structure immediately above a Corps reservoir that could possibly endanger the water supply of that project. It was suggested that we work through EPA or the state. Also, could probably get some results by releasing the story to the news media, which could result in getting the backing of concerned citizens.

7. Instream Flow Problems and Needs Evaluation.

a. Little Rock District. Eleven projects were investigated and the analysis did not yield any unexpected results. Mr. McGrew stated that the district knew that problems existed but could not quantify them. The primary quality problem is associated with releases from degraded water due to stratification of the lake. At the hydropower projects, the primary quantity problem results from the conflicts of usage of water downstream such as recreation, trout fishing, canoeing, etc. Another identifiable quantity problem that was found at several projects was the conflict of flood control operations and the encroachment in the flood plain downstream of the project. Mr. McGrew felt that the good thing that came out of this evaluation was that it had forced the districts to look at the minimal data that are available and also shows the need to actually quantify those problems that do exist.

b. Tulsa District. The Tulsa District evaluated 44 projects of which five were locks and dams and five were projects that are under construction. The results of the evaluation indicated that problems exist at nineteen projects. Mr. Horner expressed his concern for problem identification. Especially to the extent of public notification. Mr. Brown stated that the purpose of the evaluation is to identify and document quantity and quality problems associated with releases from our projects.

c. Fort Worth District. Mr. Douglas Perrin stated that the Fort Worth District evaluated 21 projects. Prior to receipt of the EC, instream flow evaluations had already been initiated. Several meetings have been held with the US Fish and Wildlife Service. The purpose of these meetings were to discuss flow needs that the service considers to be desirable below certain FWD projects. These discussions are expected to be continued. Eight projects within the district have been identified for further studies.

d. Albuquerque District. Mr. Easley stated that all of the water in the Rio Grande and Arkansas River Basins is appropriated under state laws therefore, these projects have to be operated to stay within the constraints of state laws and interstate compacts. Other basins, flows are not available for instream flow enhancement. There are periods, as long as a year where there will be no flow in the stream due to irrigation diversions. For the above reasons, a detailed analysis was not made for instream flow problems and needs evaluation.

Mr. Eiker made the following comments on instream flow evaluation. He agreed that present state laws (western states) will not permit releases from the conservation storage but this should not be an indication that these laws will not be changed. The instream flow group has devoted a major portion of their efforts on the legal question that has been raised over appropriated rights. Particularly for the 17 western states. He feels that the instream flow evaluations are very important. If the laws are changed, then at least

we will have a start in identifying what problems exist at our projects and possibly what can be done to alleviate these problems. This is very important for those projects that have been identified to have low dissolved oxygen problems. These will be closely scrutinized, presently there is litigation in the courts on these problems. Mr. Eiker stated that approximately 60 projects, Corps wide, have fallen into that category. He feels strongly that the Corps will have to correct such problems. The evaluations can serve as a data base for investigating these problems. Also the evaluations can be used as a vehicle to get funding (line item in the budget) for correcting such problems. TVA was cited as an example, they did an evaluation of their instream flow problems and needs and each project was prioritized. Through these evaluations they were able to get the necessary funding to do additional studies. He assured SWD and the districts that OCE would look closely at the reports, particularly at the overall costs for the next several years. He feels that there is a very good chance of getting a line item in the budget whether it be O&M money, GI, and ultimately construction funds. In summary, Mr. Eiker stated that he is unsure whether the instream flow reports will result in policy. He asked that SWD prioritize their project studies through the assistance of the districts.

8. Drought Contingency Plans.

The ER was first initiated by the OCE Office of Policy. They drafted the first version and the draft was reviewed by the Hydraulics and Hydrology Branch in OCE. Mr. Eiker stated that he ultimately put the draft ER together including some modifications and forwarded the ER to four divisions requesting their comments. Upon receipt of the division comments, they were incorporated into the final ER with some modifications recognizing those areas where problems could arise in implementation. To meet the requirements of the ER, Mr. Eiker's opinion is that the plan can be documented in Chapter 7 of the water control manuals with several sentences or paragraphs stating what actions will be taken during drought conditions.

Agenda
Reservoir Control Center
Southwestern Division
Corps of Engineers
19 November 1980
0800

I. Introduction

II. District Status

III. Water Control Data System

IV. Status of System Regulation Studies

V. Proposed Guidance on Section 7 Project within SWD

VI. District Water Quality Activities

VII. Instream Flow Problems and Needs Evaluation

VIII. Drought Contingency Plans

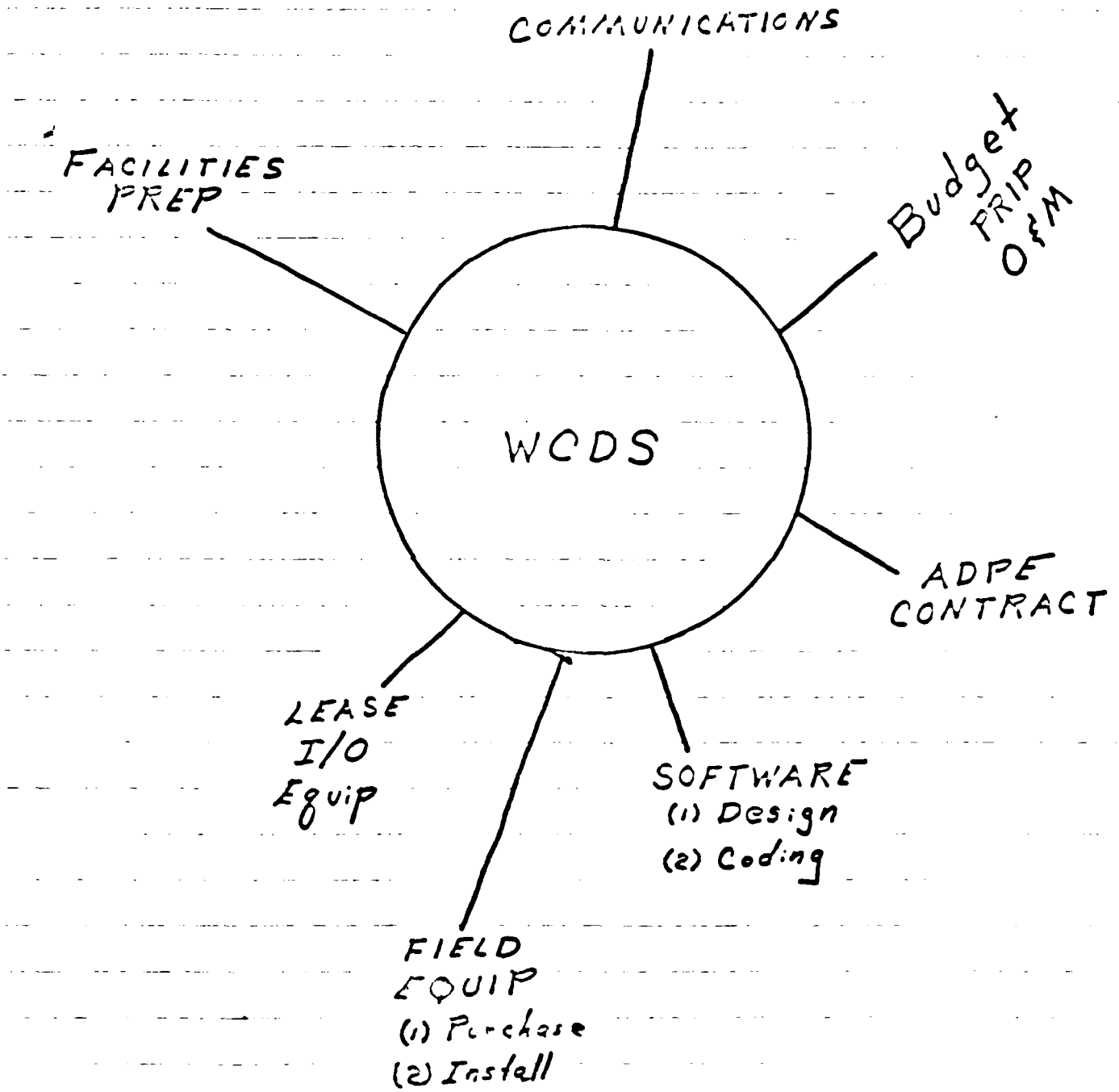
IX. General Comments

ATTACHMENT 1

RCC 1980 Annual Meeting

| NAME | ORGANIZATION |
|---|---|
| Jimmy D. Baggett | FWD Hydrology & Hydraulics |
| Chandra M. Alloju | " |
| George Carefoot | " |
| Douglas Perrin | " |
| Ross Copley | Tulsa District |
| John Cunico | Albuquerque District |
| Jim Kosclski | Galveston District |
| Terry Coomes | SWD - Water Management |
| Earl Eiker | OCE |
| Charles Sullivan | SWD - RCC |
| Wright V. Lewis | SWDCO - OR |
| Clinton Word | SWD - RCC |
| Cliff Victry | " |
| Ralph Garland | " |
| David Brown | " |
| Carroll Scoggins | Tulsa District - Hydraulics |
| William E. Isaacs | Little Rock District (SWLED-H) |
| Tom Donaldson | Ft. Worth District |
| Larry D. McGrew | Little Rock District |
| Tom Horner | Tulsa District |
| Edward E. Hudson | " |
| John Parks | SWD |
| Bob Easley | Albuquerque District |

ATTACHMENT No. 2




ATTACHMENT No. 3

# WCDS COST ESTIMATES
($1,000)

| | ADPE Purchase | Annual Costs | | |
|---|---|---|---|---|
| | | Maint-enance | I/O dev Lease | Total w/o FRIP |
| AB | 145 | 20 | 33 | 53 |
| FW | 272 | 37 | 46 | 83 |
| G | 120 | 16 | 33 | 49 |
| LR | 263 | 36 | 38 | 74 |
| TUL | 324 | 44 | 74 | 118 |
| SWD | 136 | 18 | 31 | 49 |
| | 1,260 | 171 | 255 | 426 |

ATTACHMENT No. 4

# DELIVERY OF ADPE

| | |
|---|---|
| TULSA | July 81 |
| DALLAS | Sep 81 |
| FT WORTH | Nov 81 |
| ALEUQURQUE | Jan 82 |
| GALVESTON | Mar 82 |
| LITTLE ROCK | Apr 82 |

ATTACHMENT No. 5

# SOFTWARE DEVELOPMENT

Projected Cost $1,000

| | |
|---|---|
| FY 81 | 105 |
| FY 82 | 300 |
| FY 83 | 300 |
| FY 84 | 200 |
| FY 85 | 150 |
| FY 86 | 100 |
| ⋮ | ⋮ |
| 1505 | = $1.5 Million |

# SOFTWARE

MANAGEMENT :

(1) Common

(2) Special

(3) Data Base

DESIGN :

(1) General D.M.

(2) D.M. For Each Module

CODE :

# TRAINING

| | Number | Est Man Weeks |
|---|---|---|
| Operator | 2 | 8 |
| System Mgt | 2-4 | 6-12 |
| Program/Analyst | 2-4 | 4-8 |

LAKE REGULATORS ie USERS ??

ATTACHMENT No. 7

# ADDENDUM NO. 2

## MINUTES OF WATER QUALITY MEETING

MINUTES

Water Quality Meeting
Southwestern Division, C of E
17-18 December 1980

1. Introduction. A meeting sponsored by the Reservoir Control Center (RCC) to discuss water quality subjects involved in planning, design, and operation of civil works, was held in the Southwestern Division (SWD) office on 17 and 18 December 1980. In attendance were representatives from the districts, Division, and OCE. Specialists from other organizations were also present. A list of attendees and a copy of the agenda are attacted.

Mr. Charles Sullivan of the RCC chaired the meeting. He stated that during last year's meeting we attempted to find what problems the districts had and in what areas assistance was needed. Several commitments were made to provide guidance in certain areas. It was also suggested that coordination of water quality work within the district be formalized. The first day of this year's meeting will be primarly guidance as related to District and Division Water Quality Activities. The second day will be case studies.

2. Welcome. General Robinson welcomed the group, in particularly those visitors from OCE, ORD and the Fish and Wildlife service. General Robinson mentioned that in the Southwest water quality is almost as important as water quantity. There are many areas in the Southwest that will take water and use it in an efficient and economical way almost regardless of the quality unless it is just completely out of the question because of salt content or other impurities because they are so water short. Water quality is probably the newest issue the Corps has wrestled with. Today we are much more concerned about what we can do to make water quality better. We have taken on this effort voluntarily and willingly in an effort to try to make things just a little better than they were before we came on the scene. I think we have that mandate and I think we accept it. Releases for downstream uses, fisheries and other environmental purposes, are becoming very important to us in the Corps in our considerations when evaluating potential projects and projects which we have on line today. We are studying all of our reservoirs to try to decide what we should be doing in terms of instream flow uses. There are some water law problems here which we have not even began to get into. The Corps is being sued in some cases for insisting on certain instream releases. We are being told by states that we don't have water rights to release water for instream uses. And so we are in an area that is one of particular controversy. For that reason and others we must proceed carefully but we must be persistent that we provide what we think is appropriate. Who's to determine what is appropriate? We have classic clashes with the F & WL Service. What should we be releasing. That is something we have to resolve and I hope we can resolve it on a direct exchange program, sitting down across the table in a cooperative mode and agree on the parameters, at least the range so that we are in an acceptable range.

Temperature and dissolved oxygen problems were discussed at our last annual meeting. I hope we've solved some of those problems. I'll be interested in

seeing the minutes of this meeting to see how far we've come. But these are difficult issues. We've tried several solutions for solving the D.O. problems especially below our power plants, and we'll continue to try other things to make it work. We have to solve the D.O. problem because we cannot afford both from an economical standpoint and from an image standpoint to face the issue of large fish kills. Temperature variations that affect the ecosystems downstream are important to us. We are progressing, I hope, fairly rapidly on the measurements we need so we know what we're doing when we make certain rules and are not just guessing.

The key to success in this broad area of water quality is good planning and good communication. For new projects early planning to know what we're dealing with in the existing stream where water quality is concerned and we have to be able to extrapolate that to the after project conditions and make advanced preparations to make sure we don't have some of the problems that we have with existing projects. We have to be totally communicative with those other agencies that have an interest. Old projects are a tougher problem because it's there. But I still think communications is the answer.

We all face the same problems today in terms of what we have available to us as far as resources. We should not use as an excuse the fact that we were not thinking far enough ahead and did not include funds in the budget. Make sure the funding is extrapolated to the next year and that we have sufficient funds to do the necessary water quality work. A couple of cautions that I want to mention. We are not going to get all the money for an ultimate program. Be reasonable in the approaches we take. Make sure your program is solid. Don't go overboard. Do what is necessary. Ask yourself the question "Do I need to solve the problem that exists or that I perceive?" If the answer is no, don't put it in the program because you'll only hurt the overall program.

The final caution concerns the operations of our projects. They are there to serve a congressionally mandated purpose and those purposes take some degree of presidence. There are things that we can do and things that we ought to do to minimize the impacts that those operations have on the water quality. There have been times and will be times in the future when the operation of our projects will take clear presidence. Those are two cautions that I think we must always consider when we are proposing changes that affect what's already there.

You have a very important mission and I want you to know that you have my support.

3. DISTRICT PRESENTATIONS ON WATER QUALITY ACTIVITIES

a. Fort Worth - Chandra Alloju stated that the district has no formal written organization to coordinate water quality activities or assign responsibilities. The sampling program has been expanded from 8 to 13 of the 21 district projets. Samples are taken 3 times per year, testing for standard chemicals, nutrients, Fe, Mn, and bacteriological tests. In FY 1980 we completed thermal simulation studies including answering comments for Lake View, Aubrey and Granger. A water quality report was prepared for Benbrook. Studies are being conducted for Sam Rayburn and Wright Patman D.O. problems.

Evaluations of instream flow problems and needs at all projects have been made with specific work on instream problems from below Benbrook and Sommerville.

b. Albuquerque - Andy Rosenau stated that the Albuquerque District water quality program is basically a monitoring program including measuring at all projects with water stored in them for pH, secci disc transparency, dissolved oxygen and temperature on a monthly basis. Gas saturation measuring equipment has been purchased and will be used next spring. Several projects that have semi-permanent pools have been added to this program this year. The Operations Branch has primary responsibility for the collection, storage, and evaluation of the data. Project personnel collect almost all of the data. The data is stored in the STORET computer data system. Abiquiu and Cochiti Lakes have had algal bloom problems. The cause is unknown, but the district has begun discussions with the University of New Mexico to develop a study program to identify and solve the problems. Potential water quality problems are expected in areas where water will be stored over asphaltic formations in Santa Rosa Reservoir and over coal formations at Trinidad.

c. Tulsa - Rick Hunter stated Tulsa District has developed an office memorandum setting out some of the duties associated with each branch concerned with water quality. Operations Division, Navigation Branch, has basically the section 404 permits program. Recreation Resources Branch has swimming beaches, hazardous substance spills, contamination in the project area and aquatic plants. Engineering Division, Hydraulics Branch, have studies mainly to determine discharge arrangements and things that can be done to improve water quality at existing projects. Environmental Resources Branch has water quality studies for planning and pre-impoundment studies and acts as overall water quality coordinators within the district. In FY 80, eight post impoundment type studies were conducted as part of a five year program to get good base line studies. Eleven have been completed leaving about 24 projects to do. The studies are very detailed including organics and heavy metals in the water and fish flesh. PCB contamination has been found in Ft. Gibson and Webbers Falls. Planning studies were completed for three projects and two are continuing this year. Tests were conducted at Texoma to attempt to find the cause of major fish kill in 1979. Thermal simulation of Table Rock Lake for Little Rock District and the instream flow determinations were completed. Next year, three base line studies are planned with possibility of three more if additional funding is available. A typical base line study costs $25,000 to $30,000 with about half of them having been done by contract.

d. Little Rock - Lou Cochman stated the Little Rock District water quality program is split between Con Ops and Engineering Division. Con-Ops handles 404 permits monitoring program and lake water quality monitoring-3 times per year at 6 to 8 stations on each lake testing for twenty six (26) parameters. The Greers Ferry Lake water quality report was submitted last year and a report on Table Rock Lake will be completed in the next two months. Most sampling and analysis at Little Rock Lakes has been contracted to USGS. The Corps waste water discharges are monitored by Con-Ops. The beach monitoring program utilizes the Arkansas State Laboratory which measures total coliform. They are planning to go to fecal coliform next year which will be in line with other states. The waste water treatment plants and water supply samples are taken by project personnel and analyzed by the USGA and Arkansas

State Health Department Laboratory respectively. Dredged material samples are frozen and shipped to the SWD Laboratory for analysis. Con-Ops handles the oil and hazardous substance program. Data from these activities are stored on STORET and WATSTORE. Engineering Division handles monthly lake monitoring program. The USGS takes profiles in each lake and a spot measurement downstream. Parameters include temperature, D.O., pH, and conductivity. Engineering Division is handling the instream flow problems and needs evaluation. The Table Rock dissolved oxygen study is continuing. An alternative study is underway to evaluate the cost-benefits. Planning has initiated a 208 study for waste water treatment around Greers Ferry Lake. Other studies include, Little Rock Metro Urban Study, North Fork Units 3 & 4 feasibility study, White River Lakes, and Taylor Bay.

The district has drafted a water quality management plan defining responsibilities and establishing goals and a time frame for accomplishing those goals. It includes the establishment of a water quality group which will consist of members from various district elements and hopefully provide guidance in the overall water quality program.

4. Corps of Engineers Water Quality Program

Mr. Earl Eiker stated that OCE has basically four objectives, 1) to respond to legal requirements and executive orders, 2) to accomplish our water quality function in a most cost effective manner, 3) to pursue a course of action rather than reaction, and 4) to use state of the art technical procedures for evaluations and implementation.

The instream flow effort is a clear example of action in response to an executive order, beyond that, we don't have our story straight on a Corps wide basis where our needs are. If this doesn't prohibit us, it greatly limits our capability to obtain funding to address the water quality problems. OCE felt it was prudent to pursue a course of action before the problems get to the point where public, state or other federal agencies get involved which forces us into a courtroom situation and may require implementing a solution that is truly not cost effective.

Mr. Eiker stated the annual reporting requirements in ER 1130-2-334 real purpose was to get the divisions to put together a coordinated program, to establish goals and directions in which they want to go for the next 4 - 5 years. And to force them to sit down and take a look at their programs and what has been accomplished and put them down on paper and then send them to OCE. It also is intended to make the districts take a look at their problems and write down those projects where they are having the most problems and report them into the divisions. The OCE report is to give the divisions an opportunity to take a look at what other divisions are doing, how they are progressing, what their goals and objectives are, and how they differ, how organizations differ and the success of various Corps programs. The report is not a total success but each iteration of the reporting process improves the process.

Divisions are responsible for detailed guidance to the districts. Six of the ten divisions have regulations covering water quality activities. SWD's

draft is similar to those others. The divisions should put together overall management plans detailing very clear goals and objectives, something the districts can point towards. All divisions except one have their water quality programs tied into water control management. Probably the single most important factor in water quality distribution relates to the hydrology and hydraulics aspects of an impoundment and WCM is the logical place that these are all pulled together.

As far as implementation by the districts you should look at things like clear lines of communications with local agencies. Good working relationships are needed with the states and other local agencies. Those districts and divisions that work hard with local interests are the ones that have a minimum amount of problems and bad press coverage. We also need some innovation in our approaches to problems.

5. Southwestern Division Laboratory Water Quality

Mr. George Haley summarized the capabilities of the SWD laboratory for water quality work. He also discussed planned improvements and a proposal for a mobile laboratory to assist the districts in their sampling and testing programs. The laboratory presently employees four chemists, three full time and one part time. A fourth full time chemist will be added to the staff shortly to replace the part time employee. The laboratory equipment includes; 1) a Perkin-Elmer Model 403 atomic absorption spectrophotometer (AA) and lamps which permit the identification of 23 different metals; 2) an SMI atomic emmission spectrophotometer which is an argon-plasma instrument measuring similar parameters to the AA but without the sodium interference of saline waters experienced in the AA; 3) a B & L spectrophotometer to test for arsenic ammonia etc; 4) an Oceanographic Carbon Analyzer for the determination of total organic carbon; 5) an Orion miniprocessor analyzer for determining floride, chloride and ammonia; 6) a hooded combination digestion/distillation unit used in the determination of kjeldahl nitrogen and 7) a Perkin-Elmer Sigma I gas chromatograph (GC) for pesticides, PCB's, herbicides and numerous other organic compounds. Additional major pieces of equipment under consideration to purchase are: 1) an automatic sampler to automatically run samples on the gas chromatograph (GC) at night, 2) a modification to the GC to test two different columns with a single injection and 3) a new atomic absorption analyzer. The laboratory has adequate working space even with the planned new equipment. We hope to begin inspecting commercial and university laboratories in 1981 as required in ER 1110-1-261. Another service we are considering is a van outfitted as a mobile field laboratory for sampling, performing initial testing, preserving samples, and transporting samples to the division laboratory for more extensive testing. We would like to have some feedback from you so we can determine if a field laboratory would be economically feasible.

6. SWDR 1110-2-XXX "Water Quality Management Activities at SWD Civil Works Projects."

Mr. David Brown stated that SWD had recently completed a draft division regulation on water quality activities at SWD civil works projects. A copy is included as inclosure 3. The major considerations in developing this draft

regulation are to provide the districts guidance in establishing water quality programs for operational projects, and define minimum sampling levels. There was a considerable amount of discussion on the responsibilities, data collection programs, sampling schedules, parameters monitored and sampling and testing methods. The pertinent comments will be used in the development of the final regulation. Some of the major items of discussion were as follows: Should the regulation be numbered in the 1110 series Engineering and Design or the 1130 series Project Operations; should the district responsibilities lie with a single individual, section or other organizational element. What should be the length of the intensive survey (in years), the number of samples per year, the number of tests on each sample and the need to determine flow-related variations? What parameters should be included in an intensive program? In a maintenance monitoring program? Utilization of the SWD laboratory drew a considerable amount of discussion. Some said the regulation was too detailed, some said it was just the right amount of detail and some said it was not enough detail. The need for intra-district coordination was also discussed. The SWD RCC will consolidate all of the pertinent remarks and publish a Division regulation on water quality management at Corps' reservoirs later this year.

7. Draft SWDR1130-2-9 Water Quality Monitoring of Bathing Beaches.

Mr. Mark King reviewed the regulation and asked if it met the district's needs. There was some discussion on certain aspects of the regulation. It was agreed that the regulation required some modification. King stated the regulation will be revised this year. Mr. Sullivan stated it should accomplish two things; 1) insure the safety of those using the beaches and 2) sample for parameters that will do this.

8. Water Quality Information Needed for Planning

Mr. Walt Gallaher stated that the water quality needs for civil works planning can be broken down into three project types; channels, reservoirs and costal information. (a) Water quality information for channels should include, in addition to the basic physical and chemical parameters, information on the stream morphometry, volumes and seasonal characteristics of flow, velocities and the sub-strait types and the nature of changes that can be expected with a given project. Items that will significantly affect the biota should be investigated early so that coordination with fish and wildlife to determine what mitigation may be necessary early in the project studies. (b) Information for reservoirs including reservoir regulation criteria, routings (inflow, outflow, elevations, etc.), types of structures, the nature of the outlet works and stilling basin, channel modifications downstream, retention times, settling coefficients, and evaporation all affect biota to some extent and should be investigated. c) Information on estuaries should include fresh water flow data and bio-assays.

Instream flow needs concern environmental planners especially. Hydraulic and hydrologic characteristics of reservoirs and streams are very important for instream flow needs determination. The Corps has been cooperating with the Instream Flow Group at Ft. Collins, Colorado especially in the area of habitat evaluation procedures (HEP) but engineering assistance is needed.

Fresh water inflows into estuaries is a growing concern. The first National Symposium on Fresh Water Inflows to estuaries was held in San Antonio this year with representatives from many interested agencies. It was the general concern of the symposium that our estuaries have been affected by insufficient fresh water flows especially during certain critical times. I feel the Corps has a commitment to consider fresh water flows into estuaries when planning future projects.

We are using "state of the art" computer models to predict water quality parameters during the planning process. The districts are using Dosag from SERALS, Qual II, eutrophication models from several A-E firms, and the Texas Department of Water Resources programs in conjunction with the esturene studies. The mouth of the Colorado River and Matagorda Island study was cited as an example.

It's up to planners to keep their project engineers informed as to what their water quality needs are going to be and make sure that the budget request contains funds early enough to meet those needs.

9. Instream Flows Needs - EC 1110-2-214

Mr. David Brown stated the instream flow problems and needs evaluation program was established to identify areas of water quantity and quality problems in and below Corps reservoir projects. Of the evaluations received only 10 to 15 had future planned actions and funding requirements. Several instream flow problems are currently being studied or are included in larger more comprehensive studies. We will take those with recommended actions and funding and rank them accordingly to Division requirement. Our priorities will be set based on district recommendations, however we should make a concerted effort on projects that have a problem that has been brought out by the states such as Table Rock. Funding for this program should be kept separate from your normal quality program. All project evaluations will be included as Part 3 of the SWD Reservoir Control Center 1980 Annual Report. SWD feels that each project that has a need should be studied individually and fully coordinated with state, local and other federal agencies involved. You should not attempt to get a blanket policy for all projects within a state. A portion of flood control storage can, in some instances, be used for low flow maintenance. Routing studies will be necessary to determine the risk factor involved. If flood control storage is used there must be an agreement with the conservation storage users on operation and accounting procedures.

OCE will look at all identified problems on a Corps wide basis, including the dollar amounts for both implementation of solutions where the project has been studied or studies to determine the extent of the problem and potential solutions. OCE is trying to get some idea of the magnitude of the problems on a Corps wide basis. If sufficient problems are identified OCE will try to set up a separate line item in the budget, if not any efforts will have to come from the O & M program. Budget guidance should be available in time for the FY 83 submittal.

10. Fish & Wildlife Studies

Mr. Bob Jenkins - Director, U. S. Fish and Wildlife Service, reservoir research program, headquartered in Fayetteville, Arkansas gave a brief synopsis of completed studies and current research efforts. The program basically involves obtaining all available data on fisheries resources and the environmental factors affecting the fisheries.

Dr. Larry Aggus then spoke on tailwaters fishery studies below Corps projects which were conducted under contract with WES. The work on tailwaters involved both the synthesis of available information on warm and cold water streams and developing case history studies to get quantative data on tailwaters which would represent some of the problems including addressing instream flow needs, effects of large flow variations on both reservoir and tailwater fishery resources, develop improved methods for assessing fish populations particularly for tailwaters and effects of altered releases on reservoir and tailwater fisheries resources. F & W are also very interested in minimum release criteria. Case history studies were conducted at several sights starting with minimum release criteria at small reservoirs with selective withdrawal capability for both warm and cold water releases. Warm water sites were Gillham, Arkansas, Pine Creek, Oklahoma and the two cold water sites were Green and Barron River Lakes in Kentucky. The intent was to double minimum releases after two years and see what impact it had on water quality and the biota downstream. Hydropower study sites at Beaver, Arkansas and Hartwell, South Carolina were to determine the effect of large temperature and flow variations. Additional studies of release modification, epolimnial to hypolimnial at DeGray and the reverse at Greason were underway. Greason has since been dropped.

The individual site completion reports are due in April 81, and the final synthesis of the information is due in mid 1981 which will hopefully provide solid information to evaluate D.S. needs and effects. Corps funding for work at all sites was terminated in 1980. F & WL will continue some additional work on Hartwell through 1982 to provide additional base line data.

11. Structural Modifications for Water Quality Control - Sutton Dam, West Va.

Dr. Mark Anthony, ORD, described conditions leading to their studies of the turbidity problem in Sutton Lake and gave a general description of the watershed, lake and dam. The problem develops when highly turbid storm inflows enter, plunge to bottom, and move through the lake. Travel time for the colder storm runoff through the lake to the dam may vary from 24 to 48 hours. It is not unusual for a volume of water equal to the storm runoff to be released in the time needed for the density current to travel through the impoundment. Therefore the large flood control releases were of relatively clear water that was impounded before the flood event then the post flood releases carried an excessive level of turbidity for an extended period. WES was conducting a study of a similar problem at Lost Creek Reservoir and through a careful evaluation of their problems a study was designed including data collection, mathematical reservoir simulation models, and a physical model. In the reservoir simulation, the Eiker model and a modified version of the WESTEX model which included a suspended particle settling routine were used. The models were calibrated then used to predict temperature and

turbidity for proposed structural modification and non structural alternatives such as delayed releases utilizing buffer storage or pre drawndown based on anticipated runoff. Reservoir regulation plan modifications were limited due to the small storage volume (2600 acre ft) between the top of the summer pool and critical recreation areas. The structural modification envisioned in the study involved a vertical riser attached to the upstream face of the dam covering the entrance to one sluice. No attempt was made in the mathematical modeling to precisely set the riser crest elevation. A physical model of the proposed riser at the Hydraulics Laboratory, WES was used to determined the crest elevation, alternate openings size and location and the configuration of the riser near the sluice intake. The model brought out some problem areas which were corrected in the final design. The riser was operational in June 1980 and regulation this year showed a marked improvement in turbidity. Construction costs were about $1.5 million with a total cost including data collection, modeling, flow studies etc. of about $2 million. Construction funding was in the major rehabilitation program. Only under extreme flood condition would releases be required in excess of the capability of modified intake. Therefore, most flood and post flood releases are of acceptable level of turbidity.

12. Norfork Units 3 and 4 Water Quality Studies.

Mr. Larry McGrew, LRD discussed recent studies to determine the affect of installing two additional conventional or pump back units in Norfork Dam on water temperatures in the North Fork and White River proper. The basic procedure was to model the system to simulate present conditions and proposed conditions. The Norfork and Bull Shoals projects are presently operated for a maximum temperature of 75° at a point about 35 miles downstream. The WQRRS model was used to simulate conditions in the White River because it had already been calibrated for this reach in previous studies. The WESTEX model was used for the pump back operation simulation in Norfork Lake and the proposed after bay. The simulation period used involved 9 days in mid summer simulating a 3 day holiday weekend. Flows were based on July 1975. Meterlogical data was synthesized to be consistent with the operating criteria producing maximum ambiant temperature between 96° and 104° F. Typical generation patterns were developed for existing conditions for pump back and additional conventional units. Present minimum release criteria was used including a 3 day running average of 2000 cfs combined release from Norfork and Bull Shoals Dams. Time steps for the two models were not compatible therefore the daily output from the WESTEX model had to be converted into hourly data for imput for the WQRRS model. Diurnal fluctuations were based on data from a similar but larger project in southern Missouri. The validity of this assumption may be a significant point in follow up studies. Preliminary study results indicate that releases from the afterbay would be significantly warmer than under existing conditions. During the simulation period afterbay release temperature averaged 61°F versus less than 50°F under existing conditions. The primary concern is what will happen downstream in the trout fishery. There results show that the proposed project will increase the water temperatures downstream. Mr. McGrew reviewed some of the items these studies should address in more detail.

13. Denison Dam Disolved Oxygen Studies

Mr. Richard Punnett stated Denison Dam is typical of many corps hydro power projects that have hypolimnetic releases in the summer and early fall. There have been fish kills in the past but none of them well documented. In September 1979 a major fish kill occurred consisting primarily of striped bass. The indigenous fish species were hardly affected. Tulsa District personnel met with Texas Department of Parks and Wildlife and Oklahoma Department of Wildlife Conservation personnel in December 1979 to discuss the extent of the fish kill, and its possible causes. Following that meeting Tulsa District developed a monitoring program to determine if low levels of dissolved oxygen was the only cause or if there were other factors involved. The testing program was to be small, something that could be set up and carried out rather quickly with minimum cost. Three sampling sites were selected, one in the lake just upstream from the penstocks and two downstream. Most water quality sampling and testing was done by contract but some in August 1980 was accomplished in cooperation with Oklahoma State University. Dissolved oxygen levels low as 1.8 mg/l have been measured in the releases in July and August but most fish kills have happened in September when dissolved oxygen and water temperatures are higher. Dissolved oxygen levels in September generally range from 3.0 to 4.5 mg/l while temperatures increase from around 20°c in August to 25°c in September. According to the literature, striped bass are affected by both temperature and dissolved oxygen. They prefer well-oxygenated water at 20°c or lower. In lakes they sometimes congregate around the thermocline where temperatures are more tolerant and rise into the warmer water occasionally to replenish their oxygen level. In the tailrace they do not have that option. Temperatures and dissolved oxygen levels are consistant throughout tailrace. Therefore, this combination of low dissolved oxygen and high temperatures may stress the fish beyond their limit. This past summer two tests were conducted. One test based on "what could we do on a long term basis" consisted of relatively low releases (50 to 100 cfs) through a flood control conduit where the stilling basin action would reaerate the water. The dissolved oxygen level was near saturation in the stilling basin then deteriorated to about 4 mg/l several hundred yards downstream then recharged by the time it was 2 miles downstream.

The other tests were for short term reaction to large slug releases. Releases up to 10,000 cfs were made through the flood control conduits for 30 minutes both with and without turbine releases. Although the effect of the conduit releases were almost instantaneous in the tailrace, it took one to four hours for any notable affect to be seen at the monitoring station 2 miles downstream. Dissolved oxygen levels increased about 1.8 mg/l (4.0 to 5.8) in one hour with no power releases and about 1.2 mg/l (3.3 to 4.5) in four hours with about 10,000 cfs power release. So if we were notified that a fish kill were occuring we could make a slug release with the possibility of providing some immediate improvement. The results of the continuous small releases was encouraging and we would like to pursue this further in 1981. One additional series of tests were conducted pumping surface water down into the hypolimnion at about 150 cfs continuously. Although results indicated no improvement in dissolved oxygen levels, there was a decrease in oxidizable iron, manganeze, sulfides and ammonia as nitrate nitrogen. Although dissolved oxygen levels in the stilling basin were the same, the dissolved oxygen sag further downstream was considerably reduced.

## 14. Alternative Studies for Improving Dissolved Oxygen Levels in Reservoir Releases

Mr. Tasso Schmidgall reviewed the current study of alternative means of improving dissolved oxygen levels in the releases from Table Rock Dam. Six basic concepts have been considered: 1) lake distratification, 2) hypolymnion aeration, 3) selective withdrawal systems, 4) aeration within the turbine units, 5) supplemental reservoir releases with reaeration on the spillway or in the stilling basin and 6) down stream channel aeration. Preliminary studies for Table Rock have all but eliminated lake destratification, hypolymnion aeration, and downstream aeration as viable alternatives. A weir upstream from the dam as a means of selective epilimnion withdrawal has also been eliminated from further consideration. The ineffectiveness of such a plan for Table Rock Lake was concluded from results of a computer model study of the project using the WQRRS model. Air injection in the lake or tailrace appears to be very inefficient for large reservoirs and/or large hydro power releases. Air or oxygen injection into the penstocks or draft tubes or a selective withdrawal system appear to be the most feasible at this point. A passive system with little annual O & M costs would probably be the most cost effective in the long run. An active system such as oxygen injection can be very expensive to maintain and operate. The Tennessee Valley Authority (TVA) has been experimenting with two means of aeration in the draft tube. One method is by placing baffle plates upstream from venting holes located in the turbine runner hub. This method uses the regular turbine venting system with valves blocked open. Uptakes in the range of 2-2.5 mg/l of oxygen have been measured. This method is similar to that presently being used at Table Rock except that the baffles reduce pressure at the vents and result in a significant increase in air uptake. The second test used a triangular ring baffle placed in the draft tube below the turbine runner. The bottom plate of the trianglar ring was perforated. Air is supplied from outside the powerhouse through a pipe. Air uptake by this method was sufficient to raise oxygen levels by 2.5 to 3.5 ppm but it resulted in a greater loss of head and thus loss of energy production. Losses however were less than 4%. A combination of the hub baffles and ring vents increased DO levels by 3.5 to 4.5 mg/l. TVA is presently considering refinements to the ring baffle concept in an effort to reduce energy losses. One concept is to use fewer larger individual vents around the draft tube perimeter with individual retractable baffles located above each part. With such a system, power losses would be experienced only during the low dissolved oxygen period in summer and early fall when the baffles would be in the extended position. SWD plans to keep up with these tests and consider both methods as possible alternatives for increasing dissolved oxygen levels in releases from hydropower projects.

## 15. General Discussion

The following comments were brought out.

1. Be sure to talk to your district PRIP fund people well in advance of any anticipated purchases. The PRIP funds are scheduled for

5 years in advance so lead time can be critical for any large purchase item.

2. After last years meeting we had several action items we wanted to accomplish. The two SWDR's presented this year are two of those. We should be able to use your comments from this meeting and finalize those this year.

3. We would like your comments on the SWD laboratory. How do you feel about utilizing the SWD lab?

4. Is this meeting accomplishing what the districts would like to see accomplished in an annual water quality meeting? We found in setting up the meeting that we were not sure what you'd like to hear.

5. As a result of the previous two items SWD has developed a questionnaire (enclosure 4) to be sent to all attendees. We will use the results of this questionnaire to structure next year's meeting.

ATTENDEES

SWD ANNUAL WATER QUALITY MEETING

| NAME | ORGANIZATION | FTS PHONE NO. |
|---|---|---|
| David Brown | SWD-RCC | 729-2384 |
| Larry Aggus | USFWS - Fayetville, AR | 740-0585 |
| Robert Jenkins | USFWS - Fayetville, AR | 740-0585 |
| William Nailon | SWD - Dallas, TX | 729-2303 |
| Paul Hathorn | FWD | 334-2095 |
| Walt Gallaher | SWDPL-R | 729-2302 |
| Art Feese | SWDED-FL Lab | 729-2411 |
| George Haley | SWDED-FL Lab | 729-2411 |
| Loren Mason | Tulsa District, Opn's Div. | 736-7355 |
| Wright Lewis | SWDCO-OR | 729-2429 |
| Edward Moyer | FWD | 334-2705 |
| Chandra Alloju | FWD-RCC | 334-2210 |
| Paul Rodman | FWD-RCC | 334-2210 |
| Douglas Perrin | FWD-RCC | 334-2210 |
| Richard Punnett | TD-H&H Branch | 736-7206 |
| Richard Hunter | TD - Env. Res. Branch | 736-7878 |
| Mark Anthony | ORD | 684-3070 |
| Terry Coomes | SWD - WMB | 729-2385 |
| Charles Sullivan | SWD - WR | 729-2388 |
| Earl Eiker | OCE - Eng. Division | 272-0224 |
| Larry McGrew | LRD - Hydr. Branch | 740-5441 |
| Louie Cochmon Jr. | LRD - Permits Branch | 740-5295 |
| Andrew Rosenau | SWA | 474-2776 |
| Dick Kreiner | AD - Res. Reg. | 474-2636 |
| Mark King | SWDCO - R | 729-2435 |
| Kenneth Waldie | SWDCO - RM | 729-2431 |
| James Skaggs, Jr. | SWTOD - RR | 736-7356 |
| Thomas Horner | SWTED - HE | 736-7206 |
| Edward Hudson | SWTED - HE | 736-7209 |
| Tasso Schmidgall | SWDED - TH | 729-2359 |

Incl 1

Agenda
SWD Annual Water Quality Meeting
17-18 December 1980

17 December 1000

1. Welcome - General Robinson - SWD
2. Introduction - Mr. Sullivan - SWD RCC
3. Review of District Water Quality Activities FY 1980 - District Representatives
4. Corps of Engineers Water Quality Program - Mr. Eiker - OCE
5. Southwestern Division Laboratory Water Quality Capabilities - Mr. Feese- SWD Laboratory
6. Draft of SWDR 1110-2-XXX "Water Quality Management Activities at Southwestern Division Civil Works Projects" - Mr. Brown - SWD RCC
7. Draft of revised SWDR 1130-2-9 "Water Quality Monitoring of Bathing Beaches"
8. Water Quality Information Needed for Planning - Dr. Gallaher - SWD Planning

18 December 0830

1. Instream Flow Problems and Needs Evaluation - Mr. Brown - SWD RCC
2. Research on Tailwaters Below Corps Dams - Mr. Jenkins and Dr. Aggus U.S. Fish and Wildlife Service
3. Structural Modifications for Water Quality Control Sutton Dam - Dr. Anthony - Ohio River Division
4. Norfork Units 3 and 4 Water Quality Studies - Mr. McGrew - Little Rock District
5. Denison Dam Dissolved Oxygen Tests - Mr. Punnett - Tulsa District
6. Alternative Studies for Improving Dissolved Oxygen Levels in Reservoir Releases - Mr. Schmidgall - SWD Eng.
7. General Discussion
8. Adjourn

Incl 2

DEPARTMENT OF THE ARMY
Southwestern Division, Corps of Engineers
1114 Commerce Street
Dallas, Texas 75202

Regulation
No. SWDR 1110-2-

Engineering and Design
WATER QUALITY MANAGEMENT ACTIVITIES
AT
SOUTHWESTERN DIVISION CIVIL WORKS PROJECTS

1. PURPOSE. This regulation establishes policy and provides guidance for the management of water quality in Corps impoundments and discharges therefrom and for reporting of related activities.

2. APPLICABILITY. This regulation is applicable to all Districts in the Southwestern Division. It applies to all lakes and reservoirs operated by, or at the direction of, the Corps. It does not apply to dredging activities, levee and channel work, coastal tide control, or estuarine flow activities.

3. REFERENCES.

a. ER 1130-2-415, "Water Quality Data Collection, Interpretation, and Application Activities".

b. ER 1130-2-334, "Reporting of Water Quality Management Activities at Corps Civil Works Projects".

c. Publication EPA-600/4-79-020 Mar. 1979, "Methods For Chemical Analysis For Water And Wastes", Environmental Monitoring and Support Laboratory, Environmental Protection Agency, Cincinnati, OH 45262.

d. "Manual of Analytical Methods for the Analysis of Pesticides in Human and Environmental Samples", June 1980, Health Effects Laboratory, Research Triangle Park, NC 27711.

e. "National Handbook of Recommended Methods for Water-Data Acquisition", Office of Water Data Coordination, Geological Survey, U.S. Dept. of Interior, Weston, VA.

f. "Water Quality Criteria", 1978, Environmental Protection Agency.

4. POLICY. The Corps of Engineers is clearly responsible for management of the water quality aspects of all Corps lakes and it is the policy of the Southwestern Division to promote establishment of procedures throughout the Division to meet this responsibility.

5. RESPONSIBILITIES. District Engineers will develop and implement a water quality program and designate a coordinated organizational element to manage the water quality activities involved with the operating District lakes and

reservoirs. This organizational element may be assigned other water quality functions as desired by the District Engineer but should be fully capable and be provided necessary authority and support to fulfill all the requirements of this regulation. The Reservoir Control Center, SWDED-XR, will serve as the coordinating element in the Division Office for water quality management activities covered by this regulation.

6. OBJECTIVES. This Division will continually pursue active measures to accomplish the following goals in management of the water quality of all lakes within its jurisdiction.

a. Determine the characteristics of the water in the lakes and the quality of the inflow waters.

b. Monitor changes in the quality of the water during storage.

c. Maintain continuous knowledge of the water quality properties of the discharge water.

d. Operate the discharges to provide the best quality water in the lake and in the downstream discharges possible, consistent with authorized uses of the water.

e. Coordinate water quality data collection and dissemination with other organizations to lower costs and obtain maximum benefit to all concerned with water quality.

7. DATA COLLECTION PROGRAMS. Each District will establish programs to accomplish two distinct objectives.

a. An initial intensive Program to determine the quality characteristics of the water in the inflow and that stored within the reservoir and that being discharged will be conducted at each project to establish base line conditions. It is anticipated that this will require about two years for each project to provide for determination of seasonal and flow-related variations in water quality properties. Some of the lakes may have already been sampled and tested sufficiently in the past to provide an adequate base line. Work should be started promptly on other lakes, however, it is recognized that each District will probably be able to conduct this intensive program simultaneously on only about one-fourth of the total lakes in the District. It may be possible to reduce the amount of testing in this phase if the pre-construction project investigation has provided useful data, thereby accelerating the completion of this part of the program.

b. Maintenance monitoring schedules will be established for all lakes. These will be conducted to detect significant changes in water quality in the lake and discharges, provide for monitoring parameters which were found to be of concern during the intensive initial survey, and will furnish day to day information for use in regulation of discharges, and design of future facilities.

8. SAMPLING SCHEDULES.

a. Initial Program. An intensive sampling program should be conducted to obtain background data. As a minimum, sampling should be done at the following locations.

(1) Major inflow locations.

(2) Minor inflow locations with known problems.

(3) At least one column in the lake near the outlet.

(4) The discharge immediately downstream from the structure.

(5) At approximately one mile intervals downstream for 3 or 4 miles.

One sample at mid-depth should be taken except the lake column near the outlet should be sampled at 5 or 10 feet depth intervals. Sampling should be done on the inflows when flow conditions are such to provide data on the variation of water quality properties with flow and season, say, 3 or 4 times within a year. Sampling of the lake column should be done monthly in order to establish the annual cycle of stratification.

b. Maintenance Monitoring. After the background data has been obtained by the initial intensive sampling program, the monitoring should be reduced to that necessary for management. Every effort should be made to obtain and use data gathered by others to decrease costs of the maintenance monitoring. The following should be scheduled as a minimum.

(1) Inflows that have indicated problems should be sampled as necessary.

(2) The lake column should be monitored at sufficient time and depth intervals to provide constant data for the operation of alternative discharge inlet elevations and quantities.

(3) Testing of the discharge water will be done as necessary to make more precise adjustments to selective withdrawal intakes and to assure that target temperatures and other parameters are being met as closely as possible.

c. Emergencies. In the event of unusual adverse effects on water-quality that might arise from polluting spills, floods, or other unusual events likely to affect the lake water, the District should immediately contact other responsible agencies and assist them in monitoring and identifying the hazard. Regulation of discharges should be modified as much as possible, consistent with other needs, if necessary, in control of the emergency.

d. Special Studies. When occasions arise that special water quality related work is indicated, care should be taken to assure that the work is properly authorized and funded. The amount of sampling, testing, and related studies should be that necessary only to achieve the approved objective.

9. PARAMETERS MONITORED.

a. Initial Intensive Program. In order to provide a background, major ions,

total solids and those parameters listed in the 1978 EPA "Water Quality Criteria," ref. 3.f., for the authorized uses of the water, should be tested for the inflow samples and one at mid-depth in the lake column. All of the lake column samples and the discharge samples should be tested for temperature, dissolved oxygen, pH, and conductivity.

b. Maintenance Monitoring. Those parameters found to be questionable and/or likely to exceed safe levels should continue to be monitored as long as necessary. At least two samples from the lake should be subjected to the complete list of tests annually to detect any significant changes. All samples will be tested routinely for temperature and dissolved oxygen. During unusually high level discharges into the stilling basin special provisions should be made for testing for excessive dissolved nitrogen to furnish guidance for future actions necessary in connection with this potential problem.

c. Special Studies. Sampling and testing for investigations outside the initial program and the maintenance monitoring should be planned and conducted for only that objective authorized for the special study.

10. SAMPLING AND TESTING METHODS. Sampling will be conducted in accordance with ref. 3.e., and testing in accordance with 3.c. and 3.d. Some of the tests, temperature, dissolved oxygen, and dissolved nitrogen must be done at the site. This will require special instruments and trained operators present when sampling is done. All tests that can be done off-site will be conducted by the Division Laboratory unless special authorization is obtained from SWDED to engage outside consultants or laboratories. The Division Laboratory is prepared to provide advice and assistance on sampling techniques, types of samples required, procurement of special sample containers, refrigerated shipping containers, and transportation.

11. WATER QUALITY MANAGEMENT.

a. Quality Criteria Deviations. Test reports from the laboratories, Corps, and others, reports from the public, and visual observations by project personnel will be promptly evaluated and compared with previous data. Test results will be compared with the criteria in ref. 3.c. and with the applicable State standards. Any potential problems will be reported to SWDED and to other agencies having responsibilities for water quality. Action will be taken immediately to intensify monitoring, if needed, to assist in correcting the problem, modify uses of the lake, and to change operational procedures to alleviate the adverse effects. If corrections will require extensive changes in operation, significant expenditure of funds, structural modifications, or other important steps, reports with suggested corrective measures and cost estimates will be submitted to SWD. In any case, reports will be submitted when problems have been corrected.

b. Water Level Management. Deviations in pool elevations for water quality purposes may be desired and requested by other Federal or State agencies. Prior approval from SWDED will be required for making such deviations.

c. Discharge Management. Variations in discharge quantities and qualities are obtained by the operation of ports at various levels and opening sizes. These vary considerably between projects, from a wide range of intake sizes and

elevations to those structures having very little capability for selective discharges. Since the properties of the water in the lake will, at times, vary considerably throughout the vertical section, careful planning, knowledge of the water quality variations in the lake, characteristics of the discharge facilities and continuous observation of the properties of the discharge water will be essential for providing discharges of optimum quality. The parameters that vary over greater ranges throughout the lake depth are temperature and dissolved oxygen, therefore, these are usually the criteria for choosing discharge intake elevations and opening sizes. At such times that the water in the lake is stratified, with considerably colder water at lower elevations, the dissolved oxygen is usually lower at greater depths and manipulation of the two properties independently is difficult. Schedules of reasonable target temperatures, and realistic rates of change of temperatures of the discharge water should be prepared for all projects. Regulation plans and day-to-day instructions for meeting these targets should be strictly followed.

12. DATA MANAGEMENT. Water quality data obtained by the Districts should be made available to other users by storage in automated data files to the maximum extent practicable. STORET, the system operated by EPA and WATSTORE, maintained by USGS, are two systems that may be used. Information on the use of these two systems may be obtained by contacting SWDED-XR.

13. COORDINATION WITH OTHERS. Constant contact should be kept with all other agencies having responsibilities for water quality in the District's area. Planning of water data acquisition should be coordinated to eliminate duplication of effort and reduce costs. Maximum exchange of data should be encouraged to obtain maximum benefits to all users of water quality data.

14. REPORTING. District Engineers will submit the following reports on lake water quality management as indicated.

a. Organizational arrangement for responsibility for lake water quality management, to SWDED-XR, within 30 days of publication of this regulation.

b. District water quality management plan describing goals, long term schedules, plans and schedules for initial data collection and maintenance monitoring, within 90 days, to SWDED-XR.

c. Summary of results obtained in the initial intensive program, describing existing and potential problems, comparison of findings with present criteria, Federal laws, and State standards, plans for additional studies and proposed methods for alleviation of water quality problems, to SWDED-XR, as information becomes available.

d. Water quality data useful to other agencies as it becomes available.

e. Cooperative arrangements made by the District with other organizations for water quality activities, to SWDED-XR annually.

f. Summary reports of any special water quality studies, to SWDED-XR, when completed.

g. Submission of project water quality manuals or preparation of water

quality sections in the Water Control Manual, to SWDED-XR as completed.

h. Submission of annual District water quality report, which will be comprised essentially of summaries of the above items, in accordance with ER-1130-2-334 and SWD supplements, to SWDED-XR annually by 15 December.

15. FUNDING. Budgets should be made to provide an orderly progress toward comprehensive water quality management. Costs will be included under the Water Control Management feature, (609) of the PB-2a, for submission in the "Annual Budget Request for Civil Works Activities." Close coordination should be maintained between Engineering and Operations Divisions for developing adequate funding for these programs.

(SWDED-XR)

FOR THE DIVISION ENGINEER:

DISTRIBUTION:
A; B

Water Quality Meeting Questionaire

1. Please rate all agenda items from the last meeting.

| | Most value → least value | | | | |
|---|---|---|---|---|---|
| | 5 | 4 | 3 | 2 | 1 |
| Review of district activities | [] | [] | [] | [] | [] |
| Corps Water Quality Program - Eiker | [] | [] | [] | [] | [] |
| SWD Lab water quality capabilities | [] | [] | [] | [] | [] |
| Draft of SWDR - Water quality management activities | [] | [] | [] | [] | [] |
| Draft of SWDR - Water quality monitoring of bathing beaches | [] | [] | [] | [] | [] |
| Water quality information for planning | [] | [] | [] | [] | [] |
| Instream flow problems & needs evaluation | [] | [] | [] | [] | [] |
| Research on tailwaters below Corps dams | [] | [] | [] | [] | [] |
| Sutton Dam studies - Dr. Anthony | [] | [] | [] | [] | [] |
| Norfork Units 3 & 4 WQ studies | [] | [] | [] | [] | [] |
| Denison Dam D.O. tests | [] | [] | [] | [] | [] |
| Alternative studies for improving D.O. in releases | [] | [] | [] | [] | [] |

2. Do you think the agenda should include more or less of the following types of talks.

| | more | same | less |
|---|---|---|---|
| a. Corps - SWD water quality policy | ____ | ____ | ____ |
| b. SWD guidance on 1) monitoring programs | ____ | ____ | ____ |
| 2) planning | ____ | ____ | ____ |
| c. Case studies 1) within SWD | ____ | ____ | ____ |
| 2) outside SWD | ____ | ____ | ____ |

Incl 4

3. The following questions concerning the SWD Laboratory.

a. Would it be beneficial to visit the lab and discuss its capabilities?

b. How could the lab fit into your present program?

c. What capabilities would be needed at the lab to fit your needs?

d. What capabilities would you need to be able to utilize the lab?

e. Would a mobile lab be beneficial to you for short term studies?

f. How much do you use the following labs? (please estimate)

| | % | $ |
|---|---|---|
| 1. District lab facilities | _____ | _____ |
| 2. Division | _____ | _____ |
| 3. State | _____ | _____ |
| 4. University | _____ | _____ |
| 5. Commercial | _____ | _____ |
| 6. EPA | _____ | _____ |
| 7. Other (list) | _____ | _____ |

g. Evaluation of results from the following labs.

| | Acceptable | Could be better | Questionable |
|---|---|---|---|
| 1. District | [] | [] | [] |
| 2. Division | [] | [] | [] |
| 3. State | [] | [] | [] |
| 4. University | [] | [] | [] |
| 5. Commercial | [] | [] | [] |
| 6. EPA | [] | [] | [] |
| 7. Other (list) | [] | [] | [] |

# ADDENDUM NO. 3

## MINUTES OF HES ANNUAL MEETING

Minutes
1980 Annual Meeting
Hydrologic Engineering
Southwestern Division
Corps of Engineers
18 November 1980

1. An annual meeting of hydrologic engineering personnel in the Southwestern Division (SWD) was held in the SWD office on 18 November 1980 to discuss certain items of concern relating to hydrologic and hydraulic studies. Attachment 1 outlines the agenda for the meeting. An attendance list is included as Attachment 2.

2. SWD opened the meeting by briefing the attendees on the items to be discussed as outlined on the agenda.

3. Dam Freeboard Requirements. Mr. Ray Bodine gave a general discussion on the current procedures that are to be used in SWD for determining freeboard (wave runup + wind setup) for dams. Computations of freeboard, based on procedures outlined in ETL 1110-2-221, may be performed by a computer program developed in SWD. The procedures for applying this program are presented in a program manual, "Wave Runup and Wind Setup Computational Model" dated November 1977. In the implementation of the model, the freeboard winds are to be based on the 1-hour and fastest mile winds obtained from SWD criteria (Inclosure to SWDED-XW letter dated 10 August 1979, subject: "Civil Works - Wind and Wave Fetch for Reservoir Projects - Criteria"). It was pointed out that care should be exercised in adopting freeboard winds in mountainous areas and that the procedures developed do not apply for a region along the Texas coast due to potential for hurricane winds. The effect of embankment roughness on wave runup was discussed. It was indicated that wind setup should be increased as much as 50% when a reservoir converges on the down wind side of the water body and that the wind setup can decrease slightly in case of divergence. Mr. Bodine emphasized the various consideration for selecting a particular design wave and demonstrated how a design wave, other than the significant wave, can be selected from the wave runup computational model.

4. Tulsa District (TD) raised questions with regard to using stepped soil cement on the upstream embankment slope in lieu of riprap. Because certain riprap deteriorates with time and the fact riprap placement is expensive, TD felt that soil cement may offer an alternative as a slope protection measure. The wave runup (greater than that of riprap) has been well established, through laboratory studies, for stepped soil cement slopes with relatively small vertical step dimensions in comparison to the wave heights. However, for rather large steps in comparison to the wave heights, there appears to be no information available for guidance. In an effort to reduce construction costs it was suggested that larger vertical steps may reduce wave runup to a value comparable with riprap and that a physical model tests might be warranted. It was also suggested that a vertical wall at the top

of the dam with soil cement stepped slope could be a feasible alternative in reducing the wave runup. Recently it was learned that riprap initially recommended just below the top of the dam for runup calculations for some projects was replaced during construction with rock spalls. It was agreed that this practice should be discontinued and the projects that have been altered in this manner should be identified.

5. The following agreements were made as a result of the discussion on dam freeboard requirements.

A.) More research should be done on the capability of the vertical wall proposed for soil cement embankments.

B.) An alternate procedure which would incorporate factoring the Spillway Design Flood (SDF) for determining freeboard rather than computing the necessary feet required will be discussed with the Office of Chief of Engineers (OCE).

C.) SWD will look into the possibility of initiating model tests by CERC to test soil cement (stair-stepped) embankments using various size steps with varying wave heights for each step size.

D.) Districts will put together a list of reservoir projects in which the rock spalls were placed at the top instead of the design riprap.

6. DAM SAFETY ASSURANCE PROGRAM. Discussion was led by SWD. A brief interpretation of the federal guidelines prepared by the AD-HOC Interagency Committee on Dam Safety was given. It was pointed out that the hazards a project failure would cause to people should be evaulated and that the guidelines imply that the examination and modification of dams with deficient freeboard should be prioritized according to hazard potential. Also, SWD suggested that a brief hazard analysis be included in the reconnaissance report for each project.

7. TD discussed the severity of a breach at Tenkiller Reservoir. The peak discharge as a result of a dam failure compared with that of the Probable Maximum Flood (PMF) on the Arkansas River. In comparison with other projects (Fall River, Canton and Fort Supply) being studied by TD under the dam safety program, Tenkiller is much more severe. The increases in failure peak discharges over the spillway peak discharges for the other three projects produce about a 2.0 feet increase in stages at key populated locations. The failure of Tenkiller would cause a 10 feet difference on the Arkansas River.

8. TD requested guidance on processing the reconniassance reports on the 3 projects (Fall River, Canton and Fort Supply) where stage changes due to dam failure are minimal. They were instructed to send in reconnaissance reports with recommendations and wait for responses. SWD will furnish guidance on presenting a technical hazard analysis to accompany reconnaissance reports.

9. FLOOD EMERGENCY PLANS. Implementation of the guidelines for flood emergency plans was discussed and it was the consensus of those present that the guidelines were vague and not easily understood. Main concerns pertaining to the guidelines were (1) handling of the pool areas and flooding upstream of the dam due to backwater affects of the PMF and high pool levels, (2) treatment of inflows from major tributaries and (3) the required printing criteria.

10. The guidelines indicate that outflow hydrographs and flooded area maps should be developed for the spillway design flood, spillway design flood with dam failure, and dam failure with full pool conditions. It appears that the flood emergency plans guidelines require more detail than the SWD regulations concerning this subject.

11. From the discussion, it was concluded that the districts needed more guidance on implementing the guidelines. Statement on specific releases needed clarifying and procedures for displaying inundation maps are needed.

12. SYNTHETIC DISCHARGE FREQUENCY ESTIMATES. This discussion dealt with the problem of developing synthetic discharge frequency curves which will satisfy recent OCE comments with regard to calibration procedures. Procedures that are acceptable to OCE are: (1) convert synthetic partial duration rainfall to annual series using procedures outlines in the rainfall manual, (2) develop a calibrated hydrologic model to approximate discharge frequency curves at gages using the synthetic rainfall data (calibration to frequency curves should be based on initial losses), (3) develop partial duration adjustments using long term area gages, and (4) compute expected probability using 40 years of record (40 years is the basic rainfall record in Technical Paper 40).

13. SWD pointed out the need for a task force of district personnel to develop and test procedures for development of synthetic frequency curves correlated with frequency curves at gages by use of calibrated watershed models and hypothetical frequency storms. Hopefully, this would result in a consistent procedure for the SWD region. The districts were agreeable in participating in the task force. A meeting of task force members will be scheduled for early next year to outline the procedures to be followed.

14. Mr. Ron Hula gave a brief review of the meeting between the National Weather Service, The Water and Power Resources Service and the Corps of Engineers on the National Weather Service's Hydrometeorological Report No. 52 (HMR-52). SWD requested help from the districts to test the practicality of the procedures for developing Probable Maximum Precipitation (PMP) contained in HMR-52. The districts were in agreement.

15. Mr. John Cunico of Albuquerque District (AD) discussed current sediment transport modeling on the Rio Grande. A contract has been let to model the area from Cochiti Lake to Elephant Butte including Jemez Canyon and Galisteo Dams. This will be used to predict degradation. The contractor will also be analyzing the effects of irrigation and diversion structures on sediment deposition below Rio Salado and Rio Puerco for the Standard Project Flood (SPF), 100-year and 50-year floods. AD is pleased with the technical abilities of the contractor in sediment modeling.

16. Fort Worth District (FWD) made a presentation on WATSTORE utilization. This is the United States Geological Survey (USGS) water data storage and retrieval system. The six major data files available to the user are (1) station header file, (2) daily values file, (3) peak flow file, (4) unit values file, (5) water quality file, and (6) ground water file. A handout giving a brief explanation of each file was passed out to attendees.

17. FWD discussed the use of graphics terminals. The present equipment is a Tektronix 4014 CRT along with a Graphics Tablet, Disc Unit and Hard Copy Unit. Some of the terminals' uses are plotting data, fitting curves and computing effective fetch for freeboard calculations. FWD, TD and Little Rock District (LRD) indicated they were using the graphics terminals to some extent. The districts are pleased with the CRT usage. A handout describing the uses of graphics terminals was passed out to attendees.

18. Mr. Tommy Nelson of FWD discussed wetland determinations for 404 permits. For most part the hydrologist involvement in 404 permits is to provide flood frequency and duration data for the tract of land in question. This information is needed to correlate with wetland vegetation and is especially helpful in areas where Section 404 jurisdiction is questionable. A hydrology and hydraulics study performed by the Vicksburg District as an integral part of the investigation of the Prevot Tract in relation to Section 404 jurisdiction was passed out to attendees. The study was performed to indicate duration and frequency of flooding for the subject tract of land.

19. SUMMARY. In summary, it was agreed that the following actions be taken.

A.) Research be initiated into the capabilities of large vertical soil cement steps for reduction of runup on embankments.

B.) SWD will develop a proposal and present it to OCE regarding the use of a "factor of safety oriented freeboard determination".

C.) A list of dam projects in which rock spalls were placed at the top instead of the design riprap will be furnished SWD by the districts.

D.) Districts will submit reconnaissance reports regarding the dam safety assurance program with recommendations and wait for responses from OCE as to priority for corrections.

E.) SWD will furnish guidance on presenting a technical hazard analysis to accompany reconnaissance reports on dam safety.

F.) Clarification of the guidelines for flood emergency plans will be furnished the districts.

G.) A task force will be formed to develop consistent procedure(s) for the computation of synthetic discharge frequency curves.

H.) The districts will test the practicality of the procedures for developing PMP contained in HMR-52 as soon as the final plates are furnished SWD by the NWS.

1980 Annual Meeting
Hydrologic Engineering Section
Southwestern Division
Corps of Engineers
18 November 1980
0800

AGENDA

I. Dam Freeboard Requirements. Ray Bodine will present general theory for the development of freeboard requirement for wind wave effects for different types of slope protection. General discussion to follow.

II. Dam Safety Assurance Program. Ron Hula will lead a general discussion on the dam modernization program regarding determination of the relative hazard of the SWD projects which do not meet current hydrologic criteria.

III. Flood Emergency Plans. Ron Hula will lead a general discussion on the hydrologic/hydraulic study requirements for the new Chapter 9 of Dam and Reservoir O&M Manuals.

IV. Synthetic Discharge Frequency Estimates. Ron Hula will lead a discussion in regard to developing synthetic discharge frequency curves which will satisfy recent OCE comments with regard to calibration procedures. Discussion will include the possibility of establishing a Task Force to develop a unified calibrated SWD procedure.

V. General Discussion Topics:
   a. Sediment Transport Modeling on Rio Grande (John Cunico).
   b. OMB reaction to Trinidad Spillway Modernization (John Cunico).
   c. WATSTORE utilization (Tommy Nelson).
   d. Use of graphics terminals (Tommy Nelson).
   e. Wetland determinations for 404 permits (Tommy Nelson).
   f. Miscellaneous.

Attachment 1

1980 Annual Meeting
Hydrologic Engineering
Southwestern Division
Corps of Engineers
18 November 1980

ATTENDANCE LIST

| NAME | OFFICE |
|---|---|
| | Southwestern Division |
| Sam Aiken | SWDED |
| Terry Coomes | SWDED-W |
| Ron Hula | SWDED-WH |
| Charles Sullivan | SWDED-WR |
| J. Leon Curtis | SWDED-WH |
| Sam Bates | SWDED-WH |
| B. Ray Bodine | SWDED-WH |
| Tasso Schmidgall | SWDED-TH |
| | Albuquerque District |
| John Cunico | SWAED-P |
| Frank Jaramillo | SWAED-P |
| Bob Easley (part-time) | SWAED-P |
| | Fort Worth District |
| Tom Nelson | SWFED-HH |
| James M. Medlock | SWFED-HH |
| Ronald L. Turner | SWFED-HG |
| | Galveston District |
| Jim Kosclski | SWGED-H |
| Gerald M. Dunaway | SWGED-H |
| | Little Rock District |
| William E. Issacs | SWLED-H |
| Bill Henson | SWLED-H |
| Gist Wilbur | SWLED-H |
| Chris Hicklin | SWLED-H |
| | Tulsa District |
| Carroll Scoggins | SWTED-H |
| Edward E. Hudson | SWTED-H |
| Tom Horner | SWTED-HE |
| Ross Copley | SWTED-HR |

Attachment 2

END

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