US Army Corps
of Engineers
Little Rock District

DROUGHT CONTINGENCY PLAN

APPENDIX V
TO
MASTER WATER CONTROL MANUAL

WHITE RIVER BASIN
ARKANSAS AND MISSOURI

(BEAVER, TABLE ROCK, BULL SHOALS, NORFORK, GREERS FERRY, CLEARWATER)

OCTOBER 1989

CESWD-ED-WR (CESWL-ED-HR/28 Dec 88) (1110-2-240b) 5th End
Mr. Garland/mac/214/767-2389
SUBJECT: Review Submission of White River Basin Drought Contingency Plan - Little Rock District

DA, Southwestern Division, Corps of Enginers, 1114 Commerce St., Dallas, TX 75242--0216

4 OCT 1990

FOR Commander, Little Rock District, ATTN: CESWL-ED-HR

Subject Drought Contingency Plan is approved. Report distribution should be made similar to the Water Control Manual and should include involved state and federal agencies.

FOR THE COMMANDER:

Arthur F. Jones

ARTHUR D. DENYS, P. E.
Director, Directorate of Engineering

6 Encls
wd all encls

CF (w/cy of Plan):
CECW-EH-W

CESWL-ED-HR (CESWL-ED-HR/28 Dec 88) (1110-2-240b) 4th End
Shelden/nh/501-378-6239
SUBJECT: Review Submission of White River Basin Drought Contingency Plan - Little Rock District

Commander, Little Rock District, P.O. Box 867, Little Rock, AR 72203 14 November 1989

FOR Commander, SWD, ATTN: CESWD-ED-WR

Enclosed are two copies of the final White River Basin Drought Contingency Plan.

FOR THE COMMANDER:

R. TERRY COOMES, P.E.
Ch, Engineering Div

6 Encls
wd encls 1-5
Added 1 encl

CESWD-ED-WR (CESWL-ED-HR/28 Dec 88) (1130-2-320b) 3d End
Mr. Garland/mac/214/767-2389
SUBJECT: Review Submission of White River Basin Drought Contingency Plan - Little Rock District

18 SEP 1989

CDR, Southwestern Division, Corps of Engineers, 1114 Commerce St., Dallas, TX 75242-0216

FOR Commander, Little Rock District, ATTN: CESWL-ED-HR

1. The White River Basin Drought Contingency Plan is approved subject to final report reproduction and inclusion of minor comments as contained in enclosure 5.

2. This office should be provided two copies of the report. Other report distribution should be similar to the Water Control Manual distribution to include other involved state and Federal agencies.

FOR THE COMMANDER:

for ARTHUR D. DENYS, P.E.
Chief, Engineering Division

5 Encls
wd encls 1-4
Added 1 encl

CESWD-ED-WR (CESWL-ED-HR/28 Dec 88) (1110-2-240b) 2d End
Shelden/nh/6239
SUBJECT: Review Submission of White River Basin Drought Contingency Plan - Little Rock District

Commander, Little Rock District, Corps of Engineers, P.O. Box 867, Little Rock, AR 72203-0867 23 August 1989

FOR Commander, Southwestern Division, ATTN: CESWD-ED-WR, 1114 Commerce St., Dallas, TX 75242-0216

1. Submitted for your review and approval are five copies of the subject plan. Also attached are comments from in-house, and state and federal review along with the summary of our responses.

2. I recommend the plan be approved.

FOR THE COMMANDER:

for Loren N. Pape
R. TERRY COOMES, P.E.
Chief, Engineering Division

4 Encls
1 & 2 wd
Added
3 & 4 as

CESWD-ED-WR (CESWL-ED-HR/28 Dec 88) (1130-2-320b) 1st End Mr. Garland/mac/72389
SUBJECT: Review Submission of White River Basin Drought Contingency Plan Little Rock District

30 JAN 1989

Commander, Southwestern Division, Corps of Engineers, 1114 Commerce St., Dallas, TX 5242-0216

FOR Commander, Little Rock District, ATTN: CESWL-ED-HR

The subject plan is approved for in-house coordination and coordination with other state and Federal agencies. Comments contained in the enclosure should be included in the final plan submittal in Aug 89.

FOR THE COMMANDER:

for Arthur F. Jorn
ARTHUR D. DENYS, P.E.
Chief, Engineering Division

2 Encls
Dupe cys encl 1 wd
Added 1 encl

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
POST OFFICE BOX 867
LITTLE ROCK, ARKANSAS 72203-0867

REPLY TO
ATTENTION OF

CESWL-ED-HR (1110-2-240) 28 December 1988

MEMORANDUM FOR: COMMANDER, SWD, ATTN: CESWD-ED-WR

SUBJECT: Review Submission of White River Basin Drought Contingency Plan - Little Rock District

Submitted for your review are 5 copies of the subject plan.

FOR THE COMMANDER:

Billy Moore

for R. TERRY COOMES, P.E.
Chief, Engineering Division

Encl
as

White River Basin Drought Contingency Plan
Little Rock District U.S. Army Corps of Engineers

Executive Summary

The White River Basin Drought Contingency Plan covers Beaver, Table Rock, Bull Shoals, Norfork, Greers Ferry, and Clearwater Lakes. Its purpose is to provide a basic reference for water management decisions and coordination at Corps Lakes in response to drought induced water shortages. The plan is a guide for response to problems and needs that would occur as a drought worsens. This plan identifies the foreseeable operational and physical problems that would result in meeting the users needs as the stored water is depleted. The users of authorized storage allocations would have priority in use of the conservation storage. These users include hydropower and storage contract water supply. The plan also addresses the needs of secondary users such as recreation, navigation, fish and wildlife, and others. It includes procedures and requirements for providing emergency water supply sources and releases. Drought effects on marginal domestic, municipal and industrial water supplies will likely generate requests for water stored in the Corps reservoirs as their water supplies are depleted. Section 6 of the Flood Control Act of 1944 provides an opportunity to be responsive to such request. The District Engineer is authorized to contract with states, municipalities, private concerns, or individuals for emergency water withdrawals of up to 50 acre-feet from Corps lakes. Larger amounts of water are available through routine water supply contracting procedures.

For the purpose of this plan a drought is defined as a climatically induced water shortage. It is generally of wide areal coverage and its impacts are usually over a large spectrum of interests. The plan uses the National Weather Service's Palmer Drought Severity Index (PDSI) as one indicator of the severity of drought. Generally, when the PDSI is less than zero a drought is in progress. By using this measure of severity droughts can be labeled as mild, moderate, severe or extreme. Extreme drought events occurred in the White River basin in the 1950's, 1960's and 1980's. These droughts caused damage to many row crops and pasture crops. The damage to pasture crops resulted in the shortage of livestock feed requiring forced marketing of cattle. Many communities initiated conservation measures. Several communities with marginal water supplies had to ration water or ran out completely.

Other indicators commonly used to describe drought are precipitation, streamflow, groundwater levels, and lake levels. From the standpoint of operations in the Little Rock District, the most important indicator of drought impact is the amount of water stored in the six White River projects. These lake levels

cannot, however, be used as a sole indicator of drought because many factors such as hydroelectric generation may be involved in lowering the pools.

Storage in the projects is used primarily for the authorized purposes of flood control, hydropower production and water supply. Storage is provided in the conservation pool for both water supply and hydropower. The storage allocated to hydropower is used to generate energy and is marketed by the Southwestern Power Administration. Water Supply users of project storage are required to have a storage contract with the Corps of Engineers whereby they purchase storage space in the conservation pool. Secondary or incidental uses of project storage and releases are water supply, recreation, fish and wildlife, irrigation, and navigation. A significant secondary use of the cold water hydropower releases is a put-and-take trout fishery developed below the multipurpose projects.

To establish a control means for providing an intensified response to a worsening drought, four drought levels have been established. These levels are based on duration of drought and the pool elevation at each lake. The duration of drought is indicated by the number of months that the PDSI is below zero. The upper and lower pool elevation limits were selected to group impacts that would occur as the stored water is depleted. This provides a scheme to designate a drought level that would actions, recommendations, or coordination specified for each level. These levels are numbered 1 through 4 with 4 being the most severe drought. For each level, recommended actions and coordination are provided in action charts.

Level 1 is designed as an alert phase in which the water managers monitor the onset of an apparent drought situation. The plan requires normal operational procedures and coordination. Requests and decisions for non-routine water management actions will be coordinated through normal Engineering Division procedures.

In level 2 the plan calls for expanding actions ongoing in Level 1. In addition, a Corps Drought Management Committee(CDMC) activated and chaired by the District Engineer will be used as a decision making body within the Little Rock District. On this committee will be the major division chiefs along with advisory representatives of the Office of Counsel, Public Affairs, Emergency Management, Hydraulics, and Safety. The requests and actions related to water management will be coordinated through the CDMC to assure the various functional elements of the District are responding to the drought in a coordinated and concerted effort. Requests for drought related actions will be forwarded to the CDMC for evaluation and recommended actions. The CDMC will coordinate requests and actions with appropriate Corps offices and State and Federal agencies. The Reservoir Control Section coordinates and carries out through routine command channels the water management plans and deviations

requested by the CDMC. Within 60 days of the activation of the CDMC an ad-hoc meeting of the Inter-Agency Drought Management Committee will be called to allow early input from state and federal agencies.

In level 3 the District Engineer will activate and chair an Inter-Agency Drought Management Committee (IDMC) as the interface between the CDMC and the water user's in the basin. State members will include for Arkansas representatives from the Soil and Water Conservation Commission, Department of Pollution Control and Ecology, Department of Parks and Tourism, Game and Fish Commission, Waterways Commission, Health Department, and Office of Emergency Services. For Missouri they will include representatives from the Department of Natural Resources and the Department of Conservation. The state membership can be expanded by appointment by the Governor as he deems appropriate. The state members will represent the state's needs with regards to operation of the Corps projects and use of water in the basin. Federal members of the committee will include the Little Rock District Engineer, U.S. Fish and Wildlife Service, and the Southwester Power Administration. The IDMC will provide user input and consolidate the state and federal positions on drought actions.

The Level 4 actions will begin when the remaining project conservation storage is about 10 percent. Coordination of actions during this level will follow the same procedures as in Level 3, but by Level 4 conditions have worsened to the extent that inactive storage utilization must be considered. Water rationing and apportionment may be required to maintain critical water needs. The IDMC will play a vital role in sorting out priorities, justifications, and the scope of actions and responses that will serve the most critical needs with the remaining storage.

As stated above, the Corps is authorized to provide up to 50 acre-feet of emergency water supply in a timely manner. However, before this water can be contracted the District Engineer has to identify surplus water within the project. The primary source of water that could be reallocated for drought contingency purposes and declared surplus is the inactive storage and uncontracted conservation storage of the projects. The volume of water in the inactive storage of the five power producing projects is approximately 6.03 million acre-feet. In addition to the inactive pools there is 86,000 acre-feet of uncontracted water supply storage in Beaver Lake that could be designated as surplus. Using gross approximations this potential surplus water is capable of meeting the total needs of the littoral counties in the White River Basin for at least one year.

This plan was created to fill a need for a coordinated water management response at Corps Lakes during drought conditions in the White River Basin. It recognizes the wide spread interests which depend on the basin water and provides a method for these

interests to be heard during time of severe drought. Its strong points include its flexibility and responsiveness to the needs of the users.

NOTICE TO USERS OF THIS MANUAL

Regulations specify that this Water Control Manual be used in looseleaf form, and only those sections, or parts thereof, requiring changes will be revised and printed. Therefore, this copy should be preserved in good condition so that inserts can be made to keep the manual current.

WHITE RIVER BASIN
ARKANSAS AND MISSOURI

DROUGHT CONTINGENCY PLAN

APPENDIX V OF
RESERVOIR REGULATION MASTER MANUAL
WHITE RIVER BASIN

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

October 1989

WHITE RIVER BASIN

LITTLE ROCK DISTRICT
DROUGHT CONTINGENCY PLAN
APPENDIX V OF
WATER CONTROL MASTER MANUAL
WHITE RIVER BASIN

IX - PUBLIC INFORMATION

X - RESPONSIBILITIES

TABLE INDEX

ANNEX INDEX

PLATE INDEX

LITTLE ROCK DISTRICT
DROUGHT CONTINGENCY PLANS

White River Basin

SECTION I - INTRODUCTION

1-01. Purpose of Document. The purpose of this Drought Contingency Plan (DCP) is to provide a basic reference for water management decisions and responses to a water shortage in the White River Basin induced by climatological drought. As a water management document it is limited to those drought concerns relating to water control management actions. Because of the long-term nature of a drought and the uncertainties of the specific problems that may result, this document details only a limited number of specific actions that can be carried out related to water control. Its primary value is in documenting data needed in decisions and defining the coordination needed to manage the district's water resources to insure that they are used in a manner consistent with the needs which develop. This Drought Contingency Plan is Appendix V to the White River Master Manual dated December 1954. It covers Beaver, Table Rock, Bull Shoals, Norfork, Greers Ferry, and Clearwater Lakes in the White River Basin.

1-02. Basin. The White River Basin shown in Plate 1-1 encompasses approximately 27,800 square miles. The basin contains an area of 17,200 square miles located in northern and eastern Arkansas and 10,600 square miles in south central Missouri. The White River Basin contains six multipurpose Corps of Engineer projects. Three of these, Beaver, Table Rock, and Bull Shoals, are located in tandem on the main stem of the river. Norfork, Greers Ferry and Clearwater are located on tributaries to the White River. A more detailed description of the basin and projects is provided in Section IV.

SECTION II - AUTHORITIES

2-01. Authorities.

a. ER 1110-2-1941, "Drought Contingency Plans", dated 15 September 1981. This regulation provides policy and guidance for the preparation of drought contingency plans as a part of the Corps of Engineer's overall water management activities.

b. Section 216, Public Law 91-611, (84 Stat 1830) Rivers and Harbors Act 1970. This act authorizes the Secretary of the Army to review the operation of existing Corps projects and recommend to Congress modification of their structure or operation to improve the environment.

c. ETL 110-2-251, "Preparation of Water Control Manuals", dated 14 March 1980. This document provides a guide for preparing water control manuals for individual water resource projects to include drought contingency plans.

d. ER 1110-2-240, "Water Control Management", dated 8 October 1982. This regulation prescribes the policies and procedures to be followed in water management activities including special regulations to be conducted during droughts. It also sets the responsibility and approval authority in development of water control plans.

e. Multiple Letter, CESWD-ED-WR, dated 8 June 88, subject: Drought Contingency Plans. This letter directs the Districts within the Southwestern Division to initiate preparation of drought contingency plans for their basins and projects.

f. PL 84-99, "Emergency Supplies of Clean Drinking Water" as amended by PL 95-51. This law provides the authority under which the Chief of Engineers may under certain statutory conditions construct wells and transport water to farmers, ranchers, and political subdivisions within areas determined to be drought distressed.

g. ER 500-1-1, "Emergency Employment of Army and Other Resources, Natural Disaster Procedures". This ER identifies the mission, authorities, responsibilities and chain of command of the Corps in provision of disaster assistance. Specifically it establishes guidance in the application of PL 84-99 and PL 95-51 and sets reporting and assistance request procedures.

h. EM 1110-2-3600, "Management of Water Control Systems", 30 November 1987. This regulation requires that the drought management plan be incorporated into the project water control manuals and master water control manuals. It also provides guidance in formulating strategies for project regulation during droughts.

i. Section 6, Flood Control Act of 1944, provides the authority for the Secretary of the Army to make contracts with states, municipalities, private concerns, or individuals at such

prices and on such terms as he may deem reasonable for domestic and industrial uses for surplus water that may be available at any reservoir under the control of the Department of the Army.

j. EC 1105-2-181, "Municipal and Industrial Water Supply Storage". An Army General Counsel opinion of 13 March 1986, states that Section 6 of the 1944 Flood Control Act empowers the Secretary of the Army to make reasonable reallocations between different project purposes. Thus, water stored for purposes no longer necessary, or a better use in certain cases, can be considered surplus.

k. Memorandum, CESWD-ED-WR, dated 3 August 1988, subject: Drought Contingency Plans. This memorandum transmits guidance for the development of the drought contingency plans. It specifically states that an agreement with a specified user under the limited withdrawal provision (50 acre-feet or less per user) may not exceed 1 year in duration and will have a minimum charge of not less than twenty-five dollars. If more water or a longer duration is required a normal Section 6 contract is required. This memorandum also transmits guidance regarding the application of small contract authority, suggesting that it be kept at the District Engineer level.

l. Multiple memorandum, CECW-RP, 11 Jul 88, subject: Request for Withdrawal of Small Amounts of Water Over Short Periods of Time. Drought and other emergencies affecting domestic, municipal and industrial water supplies, will likely generate requests for water stores in Corps reservoirs. This memo outlines an expedited process for dealing with such requests that can be included in drought contingency plans. District Commanders should take the initiative to make Section 6 assessments, Flood Control Act of 1944, of the availability of storage for limited withdrawals (up to 50 acre-feet of water may be allocated by the District Engineer in accordance with EC 1105-2-181). Agreements for small amounts of water withdrawals (50 acre-feet or less) may be accomplished at the District level for a term of no more than one year and a clause may be included for an automatic renewal.

m. ER 405-1-12. Provides guidance for issuing an appropriate real estate instrument for water withdrawal users who will be installing water lines or other facilities or equipment.

SECTION III - DROUGHT IDENTIFICATION

3-01. Historical.

a. General. For the purposes of this plan a drought is defined as a climatically induced water shortage. It is generally of wide areal coverage and its impacts are usually over a large spectrum of interests. The information contained here relates specifically to naturally developed historical shortages. The development of an isolated shortage at a specific location which is caused by overuse of the resource while in a normal climatic pattern is considered a man-made event. Such shortages are not considered in this document and are treated through routine water management procedures and coordination channels.

b. Experienced Droughts. It has only been since the 1890's that information has been available for the NWS to reconstruct the climatalogical records needed to analyze droughts in Arkansas in a manner sufficient for comparison with current and future conditions. This has been done by calculating the Palmer Drought Severity Index(PDSI) as an indicator of the severity of drought. Using this index, droughts are classed as incipient, mild, moderate, severe or extreme. Table 3-1 indicates the NWS classes associated with PDSI values. A more detailed discussion of this indicator is included in paragraph 3-02. Table 3-2 shows the drought periods in Arkansas since 1892, their classifications and durations. The most severe drought occurred in the early 1950's. The following paragraphs briefly describe the impacts of the 1950's drought along with two other significant events in the White River area.

Table 3-1
Classes for Wet and Dry Spells

PDSI	Class
> 4.0	Extremely wet
3.0 to 4.0	Very wet
2.0 to 3.0	Moderately wet
1.0 to 2.0	Slightly wet
0.5 to 1.0	Incipient wet spell
0.5 to -0.5	Near normal
-0.5 to -1.0	Incipient drought
-1.0 to -2.0	Mild drought
-2.0 to -3.0	Moderate drought
-3.0 to -4.0	Severe drought
< -4.0	Extreme drought

Table 3-2
Historical Drought Periods
For the State of Arkansas
1892 Through 1982

DROUGHT PERIOD (1)		(2) NUMBER OF MONTHS					
START	END	(3) INCIPIENT	MILD	MODERATE	SEVERE	EXTREME	TOTAL
May 1894	May 1895	4	5	4			13
Apr 1896	Nov 1897	2	6	6	6		20
Dec 1900	May 1902	2	4	8	4		18
Jul 1909	Apr 1910	2	5	3			10
Nov 1910	Jun 1911	3	3	2			8
Nov 1913	Nov 1914	6	4	3			13
Feb 1916	Feb 1917		5	7			12
Sep 1917	Aug 1918		2	5	2		9
May 1922	Dec 1922		1	3			4
Jan 1924	Aug 1925	6	3	5	1	5	20
Jun 1930	Jun 1931	1	4	8			13
Oct 1933	Oct 1934	4	5	3	1		13
Jul 1935	Sep 1936	4	4	2	2	3	15
Jul 1938	Dec 1938	2	3	1			6
Jul 1939	May 1940	4	3	2	2		11
Jan 1943	Jan 1944	2	4	2	4	1	13
Jun 1946	Oct 1947	7	7	3			17
May 1952	Oct 1952	1	1	3	1		6
Jun 1953	Dec 1956	3	6	14	13	7	43
Nov 1962	Jul 1964	2	2	11	4	2	21
Oct 1965	Apr 1967	4	8	7			19
Sep 1971	Jun 1972	3	4	2			9
Dec 1979	Apr 1981	7	3	6	1		17
TOTAL		69	92	110	41	18	330

(1) Drought period refers to time period that the PDSI is less than zero.
(2) See Table 3-1 for respective PDSI values for drought severity labels (mild, moderate, severe, extreme).
(3) Also includes PDSI values of 0 to -.5 which includes near normal drought classification.

(1) 1952-1956. The worst drought of record, both in intensity and duration, for the White River Basin began in 1952 and continued through the end of 1956. This drought reached its greatest severity in late summer of 1954 with a PDSI of -7.33 in the West Ozarks NWS division in Missouri and a -5.11 in the northwest NWS division in Arkansas. The NWS regional divsions are shown in Plate 3-1 and 3-2 for Missouri and Arkansas, respectively. The Annual Crop Report of 1952 published by the Department of Agriculture cited damage due to drought in the production of corn, hay and pasture crops. Reduced yields were

seen in strawberry and soybean crops. In June of 1953 the drought combined with high temperatures at the beginning of the growing season to cause poor germination of row crops. In the fall, damages were similar to 1952. As the drought reached its peak in 1954 a summer heat wave again damaged pasture, corn, hay and soybeans. The situation improved in 1955 but in 1956 the hill country of the northwestern portion of the basin saw the worst effects of the water shortage. The lake levels at Norfork and Bull Shoals reached all time lows as the demand for power and the low inflow combined to bring them down to the bottom of their conservation pools. Plans were made to pull both Norfork and Bull Shoals into the inactive storage zones but the plans were cancelled due to heavy protest from recreational interest groups. Normal minimum releases were met at Clearwater Lake throughout the drought period. Increased water demand caused problems with municipal water systems within Arkansas, but available information is sketchy. Some problems were due to limitations on treatment and distribution capacity during the periods of high demand. Specific drought impact information for southern Missouri was not available, but it is probable that problems there were similar to those experienced in northwest Arkansas.

(2) 1962-1964. A drought from late 1962 through the middle of 1964 dropping the Arkansas statewide PDSI to -4.26 and the northwest Arkansas division's PDSI to -5.31. The statewide PDSI level in Missouri reached its low during the first two months of 1964 when it dropped to -5.22, the lowest since December 1954. Although it did not match either the duration or severity of the 1950's it caused widespread damage in the farming community. The northwestern section of the basin was the hardest hit, specifically the pasture grasses and feed grains, such as corn, hay and sorghum. By August of 1963 forced marketing of livestock was heavy and by October entire herds, including breeding stock, were being liquidated due to feed and water shortage. The municipal supplies listed in Table 3-3 also felt the water shortage. By November, three communities ran completely out of water and resorted to hauling treated water from nearby supplies. Fifteen others went under severe shortage. Of these supplies the majority were uncontrolled surface sources. All were located in the mountainous areas of western or northwestern Arkansas. A drop in the groundwater elevation occurred in the southern and eastern portions of Arkansas. The dry weather combined with high temperatures to cause extensive forest fires, prompting Arkansas to suspend the 1963 hunting season. Fifty-one of Arkansas's 75 counties were declared drought disaster areas. Specific information on the drought effect in southern Missouri was not located.

Table 3-3
Arkansas Water Shortages
1962-64 Drought

Community	(1) Population
Clinton	744
Leslie	506
Marshall	1,093
Green Forest	1,038
Harrison	6,580
Yellville	636
West Fork	350
Huntsville	1,050
(2) Lincoln	820
Altus	392
Mountain View	983
(2) Hartford	531
Hot Springs	29,201
(2) Bloomer	N/A
Greenwood	1,558
Waldron	1,619
Charleston	1,036
Cave City	54

(1) Population during drought period.
(2) Ran out of water completely and resorted to hauling water from nearby communities.

(3) 1979-1981. Of the three droughts discussed here, the least severe occurred in 1980 and early 1981. The PDSI reached a -3.28 on an Arkansas statewide average and a -4.29 in Missouri. Specific information to describe agricultural and municipal drought problems in Missouri was unavailable. Hardest hit again were the northwest and west central regions of Arkansas where the PDSI went below -4.00 on a regional basis. As always, the agricultural community was the hardest hit, resulting in many counties being declared drought disaster areas. In many areas of the lower and eastern White River basin increased irrigation mitigated some of the drought effects in rowcrop agriculture, but pasture and feed grains suffered. The effect of increased pumping, accentuated by the drought, could be seen in the lowering of the water table in the eastern White River area. Many of the smaller municipal water supplies were affected by July of 1980. Most of the affected supplies, as depicted in Table 3-4, were located in the west and northwestern part of Arkansas.

Table 3-4
Community Water Shortages - 1980's
(Arkansas)

Reported Running Out of Water	Reported Water Shortage	Instituted Conservation Measures
Biscoe	Gurdon	Benton
Ward	Melbourne	Diamond City
Austin	Shannon Hills	Fort Smith
	Greenbrier	Hartford
	Plummerville	Magazine
	Huntington	Mansfield
		Vandervoort
Reported Hauling Water		Hatton
Ratclift		Warren
Caulksville		Wicks
Winslow		Lonsdale
Horatio		Prescott
Vilonia		

3-02. Severity.

a. Drought Indicators. The impact of drought is in proportion to its severity and its duration. While the concept of a drought is straightforward, the technical definition is often ambiguous. Its effects vary on different segments of the population. Some of the indicators which may be used to describe drought are presented in the following paragraphs. Each measures one or more effects of drought, but none in itself presents a comprehensive picture of the drought period. It is from indicators such as these, however, that the Corps and other water management agencies must make decisions in response to drought conditions.

(1) Palmer Drought Severity Index. The National Weather Service (NWS) utilizes a numerical index to quantify the status of the climatically induced water balance between rainfall and soil moisture. This index, the Palmer Drought Severity Index (PDSI), is routinely calculated on a statewide basis for Arkansas and Missouri and separately for each NWS climatological division within each state. There are six such divisions in Missouri and nine in Arkansas. The areas included in each region are provided on Plates 3-1 and 3-2. These indexes are made available on a weekly basis. The PDSI is regionally specific and reflects the cumulative excess or deficiency in moisture relative to seasonal norms. It typically ranges from +6 to -6 but may exceed these values in the case of a long duration of abnormal rainfall. The PDSI scale along with the NWS characterization of the corresponding moisture status is shown in Table 3-1. The PDSI is a standardized indicator and is insensitive to man-made drought.

It provides a drought severity indicator that can be used to compare diverse climatological regions. It is published by the NWS and is readily available. Plates 3-3 and 3-4 show the PDSI values of Arkansas and Missouri plotted monthly. Also presented in Plates 3-5 through 3-11 for both states are the PDSI values for each climatologic division in the White River Basin. These plots can be used to compare current index trends with those during significant historical drought periods. For storage based water supplies the duration of the drought as well as the intensity are major indicators of severity. Because the PDSI reflects general moisture conditions it is considered to be a primary indicator of potential water shortage problems within the White River basin, especially for agriculture and marginally developed water supplies

(2) Precipitation. The ultimate cause of a hydrologic drought is the shortage of rainfall. This shortage can, therefore, be used to indicate the severity of the drought. The National Weather Service publishes monthly precipitation totals and annual summaries. Also provided are monthly and annual departures from normal for individual stations and for the NWS divisions mentioned above. A slight departure, even if experienced for a long period, will have little effect on the White River Lakes. Likewise, a large departure for a short period will have little effect. Drought severity will be indicated by an extended large departure from normal. Normal monthly precipitation for the NWS divisions are presented in Table 3-5. Historical annual precipitation totals for the states of Arkansas and Missouri are presented in Plates 3-12 and 3-13.

Table 3-5
Normal White River Basin Precipitation Amounts

Arkansas:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Northwest	1.9	2.5	4.8	4.5	5.3	4.8	3.7	3.3	4.1	3.3	3.5	2.7	44.4
North Central	2.5	2.9	4.4	4.4	5.1	3.9	3.4	3.2	4.0	2.9	4.0	3.3	44.0
Northeast	3.8	3.7	4.2	4.8	5.0	3.4	3.7	3.5	4.1	2.6	4.4	4.1	47.2
East Central	4.2	4.2	5.2	5.4	4.2	3.6	3.7	2.9	3.9	2.8	4.3	4.6	49.1
Missouri:													
West Ozarks	1.6	2.1	3.5	4.0	4.7	4.5	3.6	3.1	4.3	3.4	3.0	2.4	40.2
East Ozarks	2.3	2.6	4.2	4.2	4.6	3.9	3.8	3.5	3.5	2.7	3.5	3.0	41.6
Bootheel	3.5	3.4	5.2	4.6	5.0	3.8	3.7	3.3	3.7	2.5	4.2	3.9	46.8

(3) Streamflow and Groundwater. Surface runoff trends in the White River Basin are represented by a plot of the average yearly flows at the Black Rock gage on the Black River in Plate 3-14. The Black Rock gage reflects minimal low flow influence from man-made regulation. Its drainage basin reflect both the alluvial plains and mountainous areas of north central Arkansas and south central Missouri. Because of these characteristics the gage should be a good index for low flow conditions to compare current and past low flow periods. Severe drought also has the effect of lowering the alluvial water surface. Due to high groundwater withdrawals, drought impacts are not readily apparent in the well logs of the White River area. As seen in Plate 3-15 of the saturated zone elevation of the Quaternary alluvium aquifer measured since 1929 at the Oliver well at Stuttgart, Arkansas, the effect of increased withdrawals is particularly apparent. The drought effect is not. Although recharge is primarily from precipitation percolation, any impact on water table elevation, other than that due to the increased pumping caused by climatological drought, is completely masked. Plate 3-16 shows the Heien well also near Stuttgart. This well is placed in the Sparta sand formation which subcrops beneath the Quaternary alluvium in this area. The primary drought related effect evident on this plate is the increased drawdown in 1980 when approximately 76,500 acre-feet were pumped from the aquifer in eastern Arkansas. In the eastern White River basin the trend is toward using more of the Sparta Sand due to the lowering of the saturated zone of the Quaternary alluvium. The drought impact on groundwater is even more apparent in the hill country of northwest Arkansas and southwest Missouri as evidenced by the number of communities there experiencing water shortages during drought periods.

(4) Lake Levels. From the standpoint of operations in the Little Rock District, the most important indicator of drought impact is the amount of water stored in the six White River projects. These lake levels cannot, however, be used as a sole indicator of drought because many factors other than drought may be involved in lowering the pools. Foremost among these is hydropower production. The lakes hold, by far, more water than is currently demanded by water supply or irrigation, but hydropower production uses can severely reduce the lake level. Bull Shoals and Norfork Lakes are the only large lakes within the basin that contain significant conservation storage that were in operation during the severe drought of the 1950's. The impacts of this drought are reflected in their pool hydrographs as shown on Plates 3-17 and 3-18, respectively. The indicated drawdowns at the two projects would have continued to lower levels had not a decision been made to reduce the generation as noted in paragraph 3-01. Historical hydrographs are available for all the lakes and may be used to compare current drought induced drawdowns to previous periods. Because lake levels are a direct indicator of the storage available during a drought they are considered a primary indicator of capability to react to drought.

b. Drought Action Levels. For management purposes four action levels have been designated in this plan based on the duration of drought (PDSI values less than zero) and the percentage of storage remaining in the conservation pools. The rationale for selecting the upper and lower limits of the drought levels was based on an attempt to group anticipated impacts as the drought severity increases. The four levels provide a guide for a response that is consistent with the magnitude of the drought and its resultant impacts. A detailed description of the four levels of drought response action is located in Section VII. In the early stage of drought other indicators may be used to determine if the severity is such as to warrant action. These may include the magnitude of the PDSI, localized water shortage, or the existence of requests from local governments or individuals.

SECTION IV - BASIN AND PROJECT DESCRIPTION.

4-01. Basin Description.

a. General. The White River Basin shown in Plate 1-1 encompasses approximately 27,800 square miles. An area of 17,200 square miles is located in northern and eastern Arkansas and 10,600 square miles in south central Missouri. The fan shaped basin is about 250 miles long in a north-south direction, and varies in width from about 210 miles near the Missouri/Arkansas state line to about 50 miles in the south near the confluence of the White and Mississippi Rivers. The White River and its major tributaries are described in the following paragraphs.

b. White River. The White River originates in the northwest corner of Arkansas in the Ozark Mountains. It flows in a northerly direction across the Missouri/Arkansas state line. Reentering Arkansas after flowing some 115 miles in southern Missouri, it continues southeasterly leaving the mountainous area of the basin near Batesville, Arkansas. The average annual flow rate for this region of the White River as measured at Calico Rock north of Batesville is 10,050 cfs. These Corps multipurpose lakes , Beaver, Table Rock, and Bull Shoals, are located in the upper reaches of the river upstream of Calico Rock. Groundwater in the area occurs mostly in secondary openings in the rock. Wells are generally less than 200 feet deep and yield less than 10 gal/min. The depth of water fluctuates primarily in response to precipitation and is, therefore, subject to drought effects. Below Batesville the river transitions into an alluvial plain. Just upstream of Newport, it is joined by the Black River flowing in from southeast Missouri. The average annual flow at Newport is 22,800 cfs. The majority of the prime rowcrop farmland in the basin is located in the alluvial plain of the Black and White Rivers. It is in this region of the basin that the majority of the groundwater irrigation wells are located. The underlying Quaternary alluvium aquifer here is generally capable of yields of 1,000 to 2,000 gal/min. Recharge is primarily through regional precipitation, and water levels may fluctuate due to regional climatic effects, but the primary effect on these aquifers is due to use. Many areas have shown a continual water table decline over the years due to the increased irrigation pumping. This decline is readily demonstrated by the declining trend in the two wells presented in Plates 3-15 and 3-16 which can be used to compare future groundwater levels.

c. Black River. The Black River is the largest tributary of the White River and drains 8,520 square miles or about 31 percent of the entire basin. This stream leaves the Ozark Plateaus in the vicinity of Poplar Bluff, Missouri, and flows along the Ozark escarpment for about 200 miles. The average annual flow at Poplar Bluff is 1,323 cfs and at Black Rock is 8,609 cfs. The Black River enters the White River near Newport, Arkansas, at mile 264.5. Clearwater Lake, formed by a dam on the

Black River at mile 257.4, creates a lake that extends upstream about 20 miles when full and controls a drainage area of 898 square miles.

d. North Fork River. The North Fork River is the largest tributary of the upper White River. The North Fork River rises near Mountain Grove, Missouri, and flows south into Arkansas to join the White River at mile 376.4, about 11 miles downstream from the mouth of the Buffalo River. Norfork Dam is located at mile 4.8 and creates a lake 44 miles long with a drainage area of 1,806 square miles.

e. Little Red River. The Little Red River is located in north central Arkansas and drains 1,792 square miles. The western part of the drainage basin is rough and mountainous, and the remaining part which is located in the Mississippi Alluvial Plain is relatively flat. The Little Red River is formed by the junction of its Middle and South forks and flows southeastward to join the White River. Greers Ferry Lake, formed by a dam at mile 79.0 extends upstream about 50 miles on the main stem at full pool elevation with control over 1,146 square miles of drainage area.

4-02. Project Description.

a. General. The White River Basin contains six multipurpose Corps of Engineer projects. Three of these, Beaver, Table Rock, and Bull Shoals, are located in tandem on the main stem of the river. Norfork, Greers Ferry and Clearwater are located on tributaries to the White River. Except for Clearwater, which is a rolled earth structure authorized for only flood control, they are all concrete gravity structures authorized for flood control and hydropower production. Beaver, Norfork, and Greers Ferry Lakes are currently being used for water supply. Water supply facilities are under construction at Bull Shoals. The pertinent data which describes the projects are provided in Table 4-1. The average monthly and annual inflows at the projects are presented in Table 4-2. Below each of the multipurpose lakes cold water fisheries have been developed. The releases of Bull Shoals in conjunction with those of Norfork support a trout fisheries 78 miles long to near Sylamore. Summer operation of these structures include releases made to sustain the low temperature needs of these fisheries. In addition, the releases of Table Rock from early summer through the autumnal overturn, usually in early December, are oxygen deficient. Because of this the water releases at this project must be managed to provide sufficiently oxygenated water to sustain downstream fish. Clearwater does not support a cold water fishery.

TABLE 4-1
PROJECT DESCRIPTION
WHITE RIVER BASIN

Item	Beaver	Table Rock	Bull Shoals	Norfork	Greers Ferry	Clearwater
General:						
Authorized purpose	Flood Control Power (1)Water Supply	Flood Control Power	Flood Control Power	Flood Control (2)Power (1)Water Supply	Flood Control (3)Power (1)Water Supply	Flood Control
When Authorized	1954	1941	1941	1938	1938	1938
Construction Initiated	1959	1954	1947	1940	1957	1940
Construction Completed	1965	1961	1963	1949	1964	1948
Stream	White R.	White R.	White R.	North Fork R.	Little Red R.	Black R.
River Mile	609.0	528.8	418.6	4.8	79.0	257.4
Drainage Area (sq. mi.)	1,186	4,020	6,036	1,806	1,146	898
Reservoir:						
Elevation (feet):						
Top of Flood Pool	1,130	931	695	580	487	567
Top of Conservation Pool	1,120	915	654	552	461	494
Top of Inactive Pool	1,077	881	628.5	510	435	-
Streambed	914	695	450	374	260	454
Storages (acre-feet):						
Flood Control	300,000	760,000	2,360,000	732,000	934,000	391,000
Total Conservation	925,000	1,182,000	1,003,000	707,000	716,000	21,920
(Hydropower)	808,000	1,182,000	1,003,000	704,600	714,875	-
(Water Supply)	(4)117,000	(5)27,000	0	2,400	1,125	0
Inactive	727,000	1,520,000	2,045,000	544,000	1,194,000	N/A
(Dead Storage)(6)	1,460	3,600	8,400	2,500	600	295
Total	1,952,000	3,462,000	5,408,000	1,983,000	2,844,000	412,920

(1) Water supply added under authority of the Water Supply Act of 1958
(2) Power added by Act of 1941
(3) Power added by act of 1954
(4) 40,000 AF. of this total allocation is currently under contract.
(5) 27,000 acre-feet is allocated for the Table Rock fish hatchery.
(6) Dead storage is defined as volume below the lowest invert elevation of the outlet works.

Table 4-2
Historical Average Lake Inflow Volumes
(1,000 Acre-Feet)
1968-1987

	Beaver	Table Rock(1)	Bull Shoals(1)	Norfork	Greers Ferry	Clear-water
Jan	74.2	208.2	295.1	119.1	105.4	55.2
Feb	104.7	231.9	328.6	132.3	138.2	57.2
Mar	191.1	391.0	514.2	183.5	145.6	90.2
Apr	169.3	413.9	546.6	196.3	223.9	94.3
May	123.2	357.9	561.4	188.7	166.1	76.6
Jun	82.1	227.1	341.7	106.1	55.5	39.3
Jul	21.3	143.2	369.6	74.9	10.6	26.7
Aug	16.0	138.3	199.4	48.3	8.1	19.4
Sep	29.4	100.2	157.0	46.3	26.7	20.7
Oct	55.0	113.8	146.1	52.5	47.9	23.0
Nov	114.9	229.5	274.7	99.3	111.5	51.3
Dec	113.8	237.5	373.7	121.0	185.1	62.0
Tot	1095.0	2792.5	4108.1	1368.3	1224.6	615.9

(1) Includes releases from upstream lake.

b. Physical Constraints. The water resources of the White River basin projects are best described by quantifying their individual features. These features relate to flood control storage, conservation storage and inactive storage. Within the conservation storage are commingled storage allocations for hydropower generation and water supply. The constraints placed upon these resources are set by the operating criteria and the physical limitations of the structural components.

(1) Hydropower.

(a) Conservation Pool. All White River projects except Clearwater are equipped to generate hydroelectric power. Pertinent information on each project's individual capabilities is presented in Table 4-3. As reflected in this table there are generally three turbine release rates of concern in typical operations. These are the releases at rated capacity, at the fully overloaded capacity and at the minimum operational capacity. Installed capacity is that for which the unit was designed and installed (nameplate). The maximum the unit can be run is when fully overloaded at 115% of its installed capacity. When releasing flood water, or trying to cover a peak load, the units are usually run at this rate. The minimum rate at which the units can be operated without causing mechanical damage due to vibration ranges from 10 to 20 MW depending on the particular project. As the pool drops, an elevation will be reached below which generation capacity is limited due to possible damage to

the generator units. Therefore, generator turbines are not available as a routine release device below these elevations. Based on the project drought of record denoted in Table 4-3 each project was analyzed to determine its firm energy yield. This is the amount of energy which the system can produce over the term of this drought without depleting its allocated conservation storage. In addition to the primary generators each hydropower project is equipped with 1 or 2 smaller generation units used to supply power to the project facilities. At each of these projects at least one of these units is continually running releasing a mean daily average flow of approximately 20 cfs. Beaver, Norfork and Greers Ferry have the capability to shift from station generated power to purchased power. At Bull Shoals and at Table Rock, however, a portable transformer is required before the shift can be made. There is only one portable transformer available.

(b) Flood Pool. Each of the multipurpose White River projects was designed to include flood control. Releases are made to evacuate the stored flood water as rapidly as the downstream channel has capacity. The release method and criteria for regulation are spelled out in the individual Reservoir Control Manuals. Typically, releases are made through the turbines until the release rate exceeds their capacities, at which time the spillway gates and/or conduits are utilized. Generally, the turbines are run fully overloaded or at 115% of their rated (nameplate) capacities at this time. As the storage level falls to within about one foot of the top of the conservation pool releases are generally reduced. The range of flood release rates normally used at each of the projects is shown in Table 4-4. The minimum rate reflected in this table is that which will meet the firm energy requirement of the project except at Clearwater which has no power feature. This energy is typically used during a peak demand time at a higher instantaneous release rate.

Table 4-3
Hydropower Pertinent Data

ITEM	Beaver	Table Rock	Bull Shoals	Norfork	Greers Ferry
Installed Capacity - MW	112.0	200.0	340.0	80.6	96.0
Number Of Generating Units	2	4	8	2	2
Annual Firm Energy - MWH	86,000	242,000	345,000	100,000	109,000
Critical Dry Period (1)	'53-'54	'62-'65	'62-'65	'53-'54	'53-'54
Incremental Storage - AF					
Flood Control	300,000	760,000	2,360,000	732,000	934,000
Conservation	925,000	1,182,000	1,003,000	707,000	716,000
(Power)	808,000	1,182,000	1,003,000	704,600	714,875
Inactive - to Minimum Hydropower Operating Pool Level	340,700	750,800	1,080,600	0	0
Top Of Flood Control Pool					
Elevation - Ft,Msl	1,130.0	931.0	695.0	580.0	487.0
Maximum Output - MW (2)	128.8	230.0	391.0	92.7	110.4
Maximum Discharge - CFS	8,600	13,900	22,400	6,400	7,000
Top Of Conservation Pool					
Elevation - Ft,Msl	1,120.0	915.0	654.0	552.0	461.0
Maximum Output - MW (2)	128.8	230.0	391.0	87.7	110.4
Maximum Discharge - CFS	9,000	15,100	27,600	7,300	8,000
Bottom Of Conservation Pool					
Elevation - Ft,Msl	1,077.0	881.0	628.5	510.0	435.0
Maximum Output - MW (2)	114.6	195.2	336.0	56.3	97.9
Maximum Discharge - CFS	11,000	16,200	28,100	6,200	8,700
Minimum Operating Pool Level					
Elevation - Ft,Msl	1,050.0	846.0	588.0	510.0	435.0
Maximum Output - MW (2)	81.0	135.0	210.0	56.3	97.9
Maximum Discharge - CFS	9,700	14,200	23,300	6,200	8,700
Minimum Rate Operating Limit					
Generation - MW	20.0	20.0	15.0	10.0	15.0
Discharge - CFS(3)	1,500	1,500	1,300	1,000	1,300

(1) '53 -'54 period was from 28 May 1953 to 23 December 1954.
'62 -'65 period was from 14 May 1962 to 25 February 1965.
(2) All units 115% (overload).
(3) At conservation pool level.

Table 4-4
Flood Pool Evacuation Release Rates
(cfs)

	Beaver	Table Rock	Bull Shoals	Norfork	Greers Ferry	Clear-water
Maximum Routine Rate (channel capacity)	15,000	20,000	50,000 (1)	50,000 (1)	15,000	3,700
Minimum Daily Average	900	2,600	3,700	1,300	1,200	150

(1) Maximum combined release is apportioned between Bull Shoals and Norfork not to exceed downstream channel capacity of 50,000 cfs at Newport.

(2) Water Supply. Beaver, Bull Shoals, Norfork, and Greers Ferry Lakes currently are being utilized as sources of municipal water supplies. Clearwater does not provide an in-lake water supply. Clearwater's minimum release is, however, depended upon by two communities, Piedmont and Poplar Bluff, to sustain water levels at their intakes along the Black River. Table 4-5 presents the project water supply contracts currently in effect, their allocated storage, safe yields and pertinent data related to their withdrawal capabilities. Except for Mountain Home, the intake inverts are below the bottom elevations of the conservation storage. Some systems will, however, experience water quality problems at the lower lake levels even if they can meet quantity requirements. The Beaver Water District has currently contracted 31,000 acre-feet of storage for use. They have, by authorization during the design of the project, the option on an additional 77,000 acre-feet. This storage is allocated for them until such time that it is contracted to meet their needs. The original Beaver contract specified that the storage would be contracted within 25 years by January 3, 1991. They were given a 10-year interest free period after which the interest on the cost of storage has accumulated against the Beaver Water District annually.

Table 4-5
PROJECT WATER SUPPLY AND EXISTING CONTRACTS

	WATER SUPPLY YIELD DATA			CURRENT CONTRACTS(1)			
PROJECT	TOTAL ALLOCATED STORAGE (ac-ft)	YIELD DROUGHT PERIOD	VOLUME TO YIELD 1 MGD (ac-ft)	CONTRACTOR	STATUS(1)	STORAGE CONTRACTED (ac-ft)	LOWEST INTAKE ELEV. (msl)
Beaver	117,000	May 1953 through Dec. 54	905	1. Beaver Water Dist.	exis.	(3)108,000	1046
				2. Carrol-Boone Water District	exis.	9,000	1040
Bull Shoals	880	N/A	880	1. Marion County Regional Water Dist.	exis.	880	628
Greers Ferry	(4)1,125	June 1952 through Dec. 1954	1,140	1. City, Heber Springs	prior(2)		415
				2. City, Heber Springs	nego.	1,284	
				3. Community Water Sys.	exis.	225	425
				4. Community Water Sys.	nego.	1,560	
				5. City, Clinton	exist.	900	
				6. First Pyramid Life Insurance	nego.	236	
				7. Fairfield Communit.	nego.	75	
Norfork	(4)2,400	May 1953 through Jan. 1957	800	1. City, Mountain Home	exis.	2,400	525
				2. City, Mountain Home	nego.	4,000	
Table Rock	0			NONE			
Clearwater	0			NONE			

(1) Contracts as of April 1989. Those currently under negotiation are labeled nego.
(2) The City of Heber Springs has an undefined right to withdraw water from an intake that existed prior to construction of Greers Ferry.
(3) 77,000 acre-feet of the 108,000 acre-feet is for future use.
(4) Reallocated Water Supply.

(3) Recreation. The key recreation facility effected by drought is the boat ramp. Studies have shown that as long as visitors can gain access to the water they will make use of the project. When water drops below the designed capability of the ramps, recreation use may be severely curtailed. Therefore, the lower boat ramp elevations are a key to describing the droughts effect on recreation. Launch ramps on the White River Lakes are designed to extend four feet below the 10 year drawdown. Some ramps have, however, been extended lower during past low lake level periods. Such extensions are done as the opportunity permits and the specific locations are unknown. Table 4-6 shows the design elevations of the ramps at each project. The

concessionaires and boat dock owners on the White River lakes are equipped to handle several feet of lake fluctuations without adverse effects on their operations. Lake water level fluctuations which occur after the lake is pulled significantly into the conservation pool, however, become much more costly and may be considered critical to the operation and to the economic viability of the dock. The amount of drawdown which is considered critical averages about 17 feet on the White River lakes. This magnitude of drawdown can be expected during a severe drought.

Table 4-6
Boat Ramp Design Elevations

Project	Design Elevation(1)
Beaver	1,091
Table Rock	884
Bull Shoals	634
Norfork	523
Greers Ferry	436
Clearwater	490

(1) The design elevation is 4 feet below the 10-year drawdown. Some ramps have been extended below these elevations.

(4) Inactive Storage. The inactive storage is located between the streambed and the bottom of the conservation pool. Releases from this level are possible generally through the power penstocks and the conduits of the dam. The number of conduits, their capacities, invert elevations, and pertinent inactive storage volumes are presented in Table 4-7.

Table 4-7
Inactive Storage Data

	Beaver	Table Rock	Bull Shoals	Norfork	Greers Ferry	(1) Clearwater
PERTINENT ELEVATIONS (NGVD)						
Top inactive pool	1077.0	881.0	628.5	510.0	435.0	494.0
Centerline of power penstocks	991.6	779.4	535.0	447.4	340.0	N/A
Invert of lowest conduits	938.6	722.1	477.1	395.0	283.0	467.0
Streambed at dam	914	695	450	374	260	454
STORAGE VOLUMES (AC-FT) FROM TOP OF INACTIVE POOL TO:						
Centerline of power penstocks	662,870	1,397,500	1,798,950	459,232	1,139,800	N/A
Invert of lowest conduit	725,340	1,516,900	2,036,590	541,705	1,193,380	21,715
Streambed of dam	727,000	1,520,000	2,045,000	544,000	1,194,000	21,920
NUMBER OF CONDUITS	1	4	16	11	1	3
RELEASE CAPACITY PER CONDUIT AT TOP OF INACTIVE POOL(cfs)	4,620	3,160	3,160	1,850	4,590	4,600

(1) Clearwater data refers to conservation pool.

SECTION V - WATER USES AND USERS.

5-01. Current Project Water Uses and Users. Project storage in the five multipurpose projects is used primarily for the authorized purposes of flood control, hydropower production and water supply. Secondary or incidental uses of project storage and releases are water supply, recreation, fish and wildlife, irrigation, and navigation.

a. Hydropower. Water in both the flood control pool and conservation pool is utilized to produce hydroelectric power. This power is marketed by the Southwestern Power Administration (SWPA) and is used primarily for meeting peak power demands. The projects have a combined generating capacity of 818 megawatts. Power at Beaver, Norfork and Greers Ferry is marketed by SWPA as part of a 12 reservoir system. Bull Shoals and Table Rock are marketed separately to the Association Electric Cooperative Inc. of Springfield, Missouri. Because of this the power usage and lake levels at these two projects will often follow a significantly different pattern than the others.

b. Water Supply (Non-Agricultural). Water supplies based on lake storage are allocated a volumetric storage right within the conservation pool. Water supply users of project storage are registered based on their impact to storage. Water withdrawals from Corps lakes are generally identified as either small domestic users or community and large users. Small domestic users are generally defined as withdrawing less than one acre-foot of water per year and are required to obtain a Letter Permit. This water is only for domestic purposes, such as watering lawns or gardens, or for livestock consumption. The user applies to the Chief, Real Estate Division for a letter of permission. The Chief, Permits Branch ensures a proper permit is issued. There is no cost for the permit or the water. Community or large users that would withdraw more than one acre-foot per year require storage contracts. Users pay for this storage space at a rate based on applicable project costs. The current contracts for storage are presented in Table 4-5. Detailed information on obtaining in-lake water supply for municipal and industrial needs during drought conditions is included in Section VIII of this report. Water withdrawals from streams for no more than one acre-foot per year would normally be required to obtain a Section 10/404 General permit. Larger intakes and related construction require a Section 10/404 Standard permit. Under drought distress conditions, LRD uses abbreviated permit processing procedures, and normally issue no-fee Letter Permits for temporary work. Permanent structures require normal processing procedures and a permit fee. The detailed listing of water supply users of project storage and releases excluding agriculture users are presented in Table 5-1. Any entity withdrawing water for public water use is required to register with the applicable state agency responsible for drinking water. The primary sources for obtaining inventories of water users are the Corps of Engineers Planning Division for project water contract users and the Permits Branch for other users. Public

water supply users information is available from the Arkansas State Health Department in the state of Arkansas and the Missouri Department of Natural Resources (MDNR) in Missouri. Large municipal and industrial water withdrawals or diversions are registered by the MDNR and the Arkansas Soil and Water Conservation Commission. These registers are available upon request.

c. Recreation. An incidental nonconsumptive use of the basin water is recreation. Recreational uses include fishing, boating, swimming, sight-seeing, picnicking, camping, and hunting. In general, the in-lake recreation interests place demands on the control of the lake levels rather than use of the water. They tend to desire stable lake levels at or near the top of the conservation pool. As the levels drop or rise boat access points become inconvenienced and the esthetic quality of the lake is decreased. This is viewed as an erosion of the quality of the recreation experience and, thereby, detrimental to visitation and recreation use. Total recreational visitation figures for each lake are provided in Table 5-2.

d. Fish and Wildlife. The White River Lakes support a regionally and nationally significant fisheries which provide a very important economic base for tourism. The construction of these lakes caused the loss of the native warm water fishery caused by cold water hydropower releases. As a result a put-and-take trout fishery has been developed downstream of each of the five multipurpose projects with hydropower. The dependency of these trout fisheries upon hydropower releases has required considerations to downstream water temperatures when scheduling releases. These considerations have resulted in the minimum fishwater release recommendations shown on Table 5-3. In addition to temperature, dissolved oxygen is a major consideration at Table Rock and is monitored closely from mid-summer until the autumnal overturn. The largest of these fisheries is below Bull Shoals. It extends downstream about 78 miles. The lower 4.5 miles of the North Fork River is confluent to this stretch. Similar fisheries are below Beaver and Table Rock. They both extend into the upper reaches of the downstream lakes. Lake Taneycomo extends 22 miles upstream from the privately owned Powersite Dam almost to the tailwater of Table Rock. This is the most densely used of the downstream fisheries. Below Greers Ferry the cold water fishery extends about 25 miles. Usage figures for these fisheries are shown in Table 5-4. Fish hatcheries have been constructed at Table Rock, Norfork, and Greers Ferry to maintain stockage of trout in the rivers. The operation of the Greers Ferry hatchery requires a release of 20 cfs and the Norfork hatchery requires a release of about 40 cfs. At Table Rock Lake 27,000 acre-feet of storage are included in the conservation pool to provide a release of about 20 cfs for the hatchery. The Black River below Clearwater remains a native fishery and relies on the 150 cfs minimum project release from Clearwater Lake.

Table 5-1
Surface Water Users - Project and In-Stream Sources
Municipal and Industrial

USER	SOURCE	COUNTY	TYPE	MAX. CAP (mgd)	MAX. DEMAND (mgd)	INTAKE EL. (ft,msl)	RIVER MILE	PHONE	CONTACT
Beaver Water District	Beaver	Benton	M&I	50.00		1046	656.0	756-3651	CR Star
Carroll-Boone Water Di	Beaver	Carroll	M&I	6.00	4.40	1040	612.9	253-7269	J. Summers
City, Poplar Bluff	Black River		M&I				211.1		
City, Piedmont	Black River		M&I						
James Holland	Black River		Recreat						
Pocahontas Water/Sewer	Black River	Randolph	M&I	2.50	1.50			892-3222	W. Daniels
Marion Co. Water Dist.	Bull Shoals	Marion	M&I						
City, Clinton	Greers Ferry	VanBuren	M&I	1.80	1.80			745-4320	H. Moore
Community Water Works	Greers Ferry	Cleburne	M&I	1.00	1.20	425		825-7294	W. Francis
Kenneth W. Rolan	Greers Ferry		Recreat						
City, Judsonia	Little Red	White	M&I	.60	.55			729-5314	R. Wools
Fairfield Community	Little Red		M&I						
Fairfield Community	Little Red		M&I	.08		434	5.8		
Heber Springs Water De	Little Red	Cleburne	M&I	3.10	2.50	415		362-5501	
Pangburn Water Co.	Little Red	White	M&I	.72	.28			728-3311	C. Durham
Raft Creek Water Co.	Little Red		M&I	79.20		170	9.6		
Searcy Water System	Little Red	White	M&I	8.40	.62			268-2481	C. Buckner
Thunderbird Country Cl	Little Red		Indust	.08		434	85.9		
Mountain Home Water	Norfork	Baxter	M&I	4.00	4.09	525		425-5115	RE Hurst
AP&L Independence	White River		Indust	29.40		237	268.3		
Arkansas Eastman	White River		Indust	51.80		209	286.0		
Arkansas Electric Co.	White River		Power						
City, Batesville	White River	Independence	M&I			234	295.5	793-7665	L. Tharnish
City, Bull Shoals	White River	Marion	M&I	.00	.00	450	418.1	445-4775	F. Sternberg
City, Cotter	White River	Baxter	M&I	.23	.10			435-6325	F. Depriest
City, Mountain View	White River	Stone	M&I			284	340.1		

Table 5-2
Project Recreation Visitation

Project	(1) Recreation Visitors Day
Beaver	4,606,000
Table Rock	6,458,000
Bull Shoals	5,206,000
Norfork	3,982,000
Greers Ferry	5,158,000
Clearwater	988,000

(1) 1987 Visitor Count

Table 5-3
Minimum Fishwater Releases

Project	Period of Time In Effect	Forecast Air Temperature at Calico Rock							
		90 degrees or Below		91 - 95 degrees		96 - 104 degrees		105 Degrees and Above	
		Generation (MWH)	Discharge (MWH)	Generation (MWH)	Discharge (MWH)	Generation (MWH)	Discharge (MWH)	Generation (MWH)	Discharge (MWH)
Beaver (1)	May 1 - Oct 15	29	85	43	125	56	165	68	200
Table Rock	May 1 - Dec 1	34	100	48	140	60	175	68	200
Bull Shoals (2)	May 1 - Oct 15	80	250	120	375	160	500	240	750
Norfork (2)	May 1 - Oct 15	40	145	60	218	80	290	100	360
Greers Ferry (3)	May 1 - Oct 15	35	115	45	150	54	175	69	225

(1) If feasible, minimum one hour morning and afternoon.
(2) The minimum combined operation at Bull Shoals and Norfork shall not be less than a 3-day summation of 6,000 DSF. Any 3-day daily average shall not be less than 2,000 DSF. This applies for all air temperature conditions above 85 degrees.
(3) Increase required release by 50 percent on one day of a 3-day period.

Table 5-4
Average Annual Downstream Fishery Usage
(1979-1981 AGFC Angler Use Determination)

Tailwater	Length (miles)	Angler Use Days/Year
Bull Shoals	78	300,000
Greers Ferry	25	(70,000)
Beaver	7	(20,000)
Norfork	4.	28,000
Table Rock	22	300,000

Note: Numbers in parentheses are rough estimates based on recent trout stamp purchases.

e. Agricultural. Downstream of the project, persons whose lands adjoin the river have riparian rights to withdraw reasonable amounts for any purpose. During the growing season a large number of farmers pump from the White River and its tributaries, especially on the lower reaches. Total usage is unknown but usage as reported to the Arkansas State Soil and Water Conservation Commission are shown by littoral counties in Table 5-5.

f. Navigation. The White River is maintained by the Memphis and Little Rock Districts for navigation by limited dredging through Newport. The Little Rock District is responsible for dredging the White River Entrance Channel from river mile 0.0 to 10.3. The Memphis District is responsible for dredging above river mile 10.3 to Newport. While there are no navigation structures active on the river at this time, there is one proposed at the mouth. This structure would provide an entrance to the McClellan-Kerr Arkansas River Navigation System. Navigation is a nonconsumptive use and has no authorized storage in any of the White River projects. Maintenance of navigation depths depends entirely on natural flow and incidental project releases. Freight tonnage figures for 1986, as reported in "Waterborne Commerce of the United States, 1986", showed 504,092 short tons of total haulage on the White River system. Average tonnage for the previous 5 years was 594,589 short tons. The 1986 tonnage was composed of 77 percent grain, 17 percent fertilizers, and 6 percent sand and gravel. The majority of the grains shipped were soybeans and wheat.

Table 5-5
White River Basin Agricultural Water Use
By County
(million gallons per day)

ARKANSAS (1)

	RURAL USE				IRRIGATION			AQUACULTURE	
	DOMESTIC	LIVESTOCK							
County	GROUND WATER	GROUND WATER	SURFACE WATER	TOTAL	GROUND WATER	SURFACE WATER	TOTAL	GROUND WATER	SURFACE WATER
Arkansas	.34	.033	.048	.421	318.986	137.676	456.662	10.088	13.791
Baxter	1.14	.069	.391	1.600	0	.088	.088	.495	21.18
Boone	1.01	.163	.923	2.096	0	.077	.077	.090	.072
Carroll	.63	.293	1.657	2.580	0	.105	.105	0	.118
Clay	.76	.093	.093	.946	141.764	11.090	152.854	1.110	.083
Cleburne	.19	.536	.803	1.529	0	.036	.036	0	11.383
Independence	1.06	.390	.911	2.361	23.052	.041	23.093	.084	.331
Izard	.42	.116	.656	1.192	.023	.084	.107	.038	0
Jackson	.36	.054	.084	.498	211.050	5.560	216.610	2.763	.747
Lawrence	.68	.061	.345	1.086	155.834	0	155.834	1.059	.212
Marion	.59	.080	.454	1.124	0	.008	.008	3.214	0
Monroe	.23	.012	.019	.261	117.090	14.820	131.610	33.154	.662
Phillips	.51	.034	.052	.596	65.555	.560	66.115	.037	.094
Prairie	.10	.044	.068	.212	149.440	39.250	188.690	24.857	22.085
Randolf	.69	.078	.444	1.212	42.720	2.560	45.280	.354	.217
Van Buren	.57	.106	.597	1.273	.019	.048	.067	0	.123
Washington	2.31	2.633	3.950	8.893	0	.389	.389	3.214	.139
White	1.28	.478	.719	2.477	43.918	42.038	85.976	.757	3.450
Woodruff	.28	.016	.025	.321	157.502	0	157.502	.609	3.854
Totals	13.15	5.29	12.24	30.68	1426.95	254.43	1681.10	81.92	78.54

MISSOURI (2)

	Domestic			Irrigation		
	Ground			Ground		
County	Water	Surface	Total	Water	Surface	Total
Barry	0	0	0	0	0	0
Butler	0	0	0	57.32	.052	57.372
Ozark	0	0	0	0	.004	.004
Reynolds	.088	0	.088	0	0	0
Stone	.181	0	.181	0	0	0
Taney	0	0	0	0	.082	.082
Wayne	0	0	0	0	0	0
Totals	.269	0	.269	57.320	.138	57.458

(1) Values are provided by the United State Geological Survey and are based on 1982 water usage data.

(2) Values provided by State of Missouri, Department of Natural Resources and are based on 1986 water usage data.

5-02. Available Storage Surplus to Current Needs. Surplus water in the projects is identified based on criteria defined in EC 1105-2-181. Surplus water is defined by either of the two following statements: (1) Water stored in a Department of the Army reservoir which is not required becaused the authorized need for the water never developed or the need is reduced by changes which have occurred since authorization or construction. (2) Water which would be more beneficially used as municipal and industrial water than for the authorized purpose and which when withdrawn would not significantly affect authorized purposes over some specified time period. Based on this criteria the primary source of water that could be reallocated for drought contingency purposes is in the inactive storage and the uncontracted water supply of the multipurpose projects. This water could be declared surplus and contracts could be issued for its disposition under the procedures outlined in Section VIII of this plan. The volume of water in the inactive storage of the five power producing lakes is approximately 6.03 million acre-feet. The uncontracted water supply storage in the multipurpose projects is 77,000 acre-feet located in Beaver Lake. The actual amounts of inactive storage in each project are shown in Table 4-7. This table also shows the lowest conduit elevations at which this storage may be released if required.

5-03. Potential Project Water Uses and Users.

a. Uses. Potential uses of project waters and releases are expected to be similar to current uses. It is anticipated that during drought the demand for water would increase due to a large soil moisture deficit.

b. Users. Potential users during a drought are current users and water consumers currently not drawing from a project or downstream of a project which have the capability to use either directly or indirectly project water or releases. For example, a potential user could obtain water from a current user, such as by tapping into existing water lines or by hauling water by truck. In such a case, the current water user may have to withdraw water at a maximum rate. Another example of potential users would be an irrigator or industry located adjacent to the water source with the capability to extend intake pipes into a lake or river. Regardless of the logistics of supplying water for potential drought problems, our capability to meet these requirements is confined to the water available from surplus storage.

(1) Municipal and Industrial. The potential demand which can develop for municipal and industrial water from the White River and the Corps lakes during a drought cannot be estimated with any reliability. However, the annual rates of Table 5-6 do provide insights into the upper limits for potential annual demands for current developments in littoral counties of lakes and rivers. The total average annual use rate is 61.4 mgd. Maximum monthly, weekly, and daily rates data are not available. The annual rates, however, are more indicative of the total lake storage volumes which would be needed to supply water for each county during an extended drought. Assuming negligible inflow and losses, the storage volume needed to meet this demand for one year is 69,000 acre-feet. This is, therefore, within the capability to be supplied from inactive storage as reflected in Table 4-7. It is not anticipated that this total potential demand will develop within a drought because of the logistics of transporting the water.

Table 5-6
Municipal and Industrial Water Demands by County
White River Basin
(Counties that border lakes and river)

State of Arkansas County:	Public Supply (mgd) Ground Water	Surface Water	Total	Self Supplied Industry (mgd) Ground Water	Surface Water	Total
Boone	1.668	.030	1.700	0	0	0
Washington	.015	15.043	15.060	.041	.020	.061
Carrol	1.650	.920	2.570	.020	0	.020
Marion	.560	0	.506	.185	.060	.245
Baxter	.460	1.610	2.070	.233	0	.233
Izard	1.134	0	1.134	.005	.170	.175
Independence	1.130	2.530	3.660	.127	0	.127
Jackson	1.595	0	1.600	.742	0	.742
White	.489	3.348	3.840	.034	0	.034
Woodruff	.728	0	.728	0	0	0
Prairie	.857	0	.857	0	0	0
Monroe	1.296	0	1.300	0	0	0
Arkansas	3.430	0	3.430	.104	0	.104
Phillips	3.405	0	3.410	2.362	0	2.362
Van Buren	.035	.716	.751	.003	0	.003
Cleberne	.130	1.800	1.930	.216	.001	.217
Clay	1.147	0	1.150	.043	0	.043
Randolf	.206	.453	.659	.015	0	.015
Lawrence	1.341	0	1.341	.007	.080	.087
Totals	21.276	26.450	47.696	4.137	0 .331	4.468
State of Missouri County:						
Barry	2.960	0	2.960	Not available for Missouri		
Stone	.427	0	.427			
Taney	.716	.930	1.646			
Ozark	.105	0	.105			
Wayne	.184	.385	.569			
Reynolds	.216	0	.216			
Butler	1.316	1.937	3.253			
Totals	5.924	3.252	9.176			

Note: Values for Arkansas are based on 1982 water usage and were provided by the United States Geological Survey. Missouri values were provided by the State of Missouri, Department of Natural Resources.

(2) Hydropower. Hydropower generation is limited by equipment constraints. Generation ceases at the minimum operating pool levels of Table 4-3. This represents the maximum potential inactive storage that can be used in severe drought conditions. At these elevations the approximate maximum generation rates and release rates obtainable are also cited in Table 4-3. The total storage available in the inactive pool to this lower limit for each project is also listed in Table 4-3. At the average maximum release rates attainable from the bottom of conservation pool to the minimum operational limit, the available storage could produce the following approximate energy (MWH) and hours of plant operation as total hydropower user potential, less evaporation losses.

PLANT	OPERATION HOURS (Hrs)	ENERGY PRODUCTION (MWH)
Beaver	399	39,022
Table Rock	593	97,861
Bull Shoals	503	137,211
Norfork	0	0
Greers Ferry	0	0
Total	1,495	274,094

(3) Agricultural. Potential agricultural needs which can develop along the White River system are not directly quantifiable. The total usage figures presented in Table 5-5 provide the upper limits of this potential for current levels of agriculture. The total usage is 2,161,000 acre-feet per year. This volume usage could be provided from inactive storage pools for at least a year. However, this total demand on Corps lakes is not anticipated to develop because of the logistics of moving the water.

(4) Fishery. Current minimum releases for fishery maintenance are based on protection of the put-and-take cold water fishery downstream of the hydropower projects. What an absolute minimum need would be in a drought is unknown, but it should be not greater than the current releases, which averages 4,000 acre-feet per day (2,000 DSF) for the period 1 May through 15 October (Table 5-3). To sustain this release without benefit of hydropower releases would require 672,000 acre-feet of water. This much storage is available within the inactive pools.

(5) Others. The potential drought related users of lake and river waters for other purposes (i.e. water quality, navigation, wildlife, recreation, etc.) are not separately quantifiable. They are recognized primarily as secondary users of the waters that would be available for other purposes.

(6) Totals. To meet all the above (paragraphs 1 through 5) as separate needs would require a total volume of water of 5,074,000 acre-feet. The total of inactive storage of Beaver, Table Rock, Bull Shoals, Norfork, and Greers Ferry is 6,030,000 acre-feet. The inactive storage is capable of meeting the total needs of at least a year and probably longer, especially when the needs are combined. For instance, releases made for hydropower would also meet many of the downstream needs for water supply, agriculture, and fishery needs. These are gross approximations which neglect evaporation, leakage, and user access to the lakes and the rivers. In actual cases all these variables would be evaluated in establishing actual needs and capabilities.

SECTION VI - CONSTRAINTS

6-01. Legal.

a. State Water Law. Arkansas and Missouri, like most states with an abundance of water, adhere to a theory of water rights which is termed "riparian rights". In such states which utilize the riparian theory there are two basic doctrines. These are the doctrines of "reasonable use" and of "natural flow". The common law "natural flow" rule recognizes that an owner of land contiguous to a flowing stream has the right to insist that the water shall continue to flow as it has been accustomed without upstream users effecting its quality or quantity. The other doctrine, that of "reasonable use", allows that an owner must use water with a reasonable regard to the rights of other owners. Arkansas has tended to over the years to follow the "reasonable use" doctrine although, as with most eastern states, it appears to have maintained some vestige of the "natural flow" theory. In times of shortage Arkansas has codified a "reasonable use" test for allocating scarce water among competing water uses. Missouri has no such allocation procedure.

b. Arkansas Statutes. The following paragraphs provide a brief encapsulation of Arkansas statutes applicable to drought contingency.

(1) Arkansas Soil and Water Conservation Commission. Under ACA 15-20-201 (1987) the Arkansas Soil and Water Conservation Commission was established in 1963. It assumed duties of various commissions, including the duties of the Water Conservation Commission under Act 81 of 1957. This commission was given by ACA 15-22-217 (1989) the power to

(a) Issue permits for the construction of dams to impound water;

(b) Issue certificates of registration of water diverted from streams; and

(c) Make allocations among persons taking water from streams during periods of shortage to the extent and in the manner provided by law.

(2) Allocation. The key provision to this statute with regard to drought deals with the allocation of water. This statute reads as follows:

> **15-22-217. Allocation during shortages.**
>
> (a) Whenever a shortage of water in any stream, or part thereof, exists to the extent that there is not sufficient water therein to meet the requirements of all water needs, the commission, on its own initiative or on the petition of any person affected by such shortage of water, after notice and hearing, may allocate the available water therefrom among the uses of water affected by the

shortage of water in a manner that each of them may obtain an equitable portion of the available water.

(b) In allocating water in such a case, the commission may consider the use that each person involved is to make of water allocated to that person.

(c) In making such allocations of water, reasonable preferences shall be given to different uses in the following order of preference:

1. Sustaining life;
2. Maintaining health; and
3. Increasing wealth.

(d) Water needs shall include domestic and municipal water supply needs, agricultural and industrial water needs, and navigational, recreational, fish and wildlife, and other ecological needs.

(e) The following priorities shall be reserved prior to allocation:

1. Domestic and municipal domestic;
2. Minimum streamflow;
3. Federal water rights.

(3) Determination of Needs. The Arkansas Soil and Water Conservation Commission is tasked by Statute 15-22-301 to make determinations of water use requirements within the state. This includes determining the surface water requirements of fish and wildlife and navigation. They also determine all other needs to specifically include municipal, industrial and agriculture water. The Commission sets minimum stream flow requirements and sets guidelines for evaluation of proposed inner basin and interstate water transfers. In addition ACA 15-22-503 (1989) requires the Arkansas Soil and Water Conservation Commission to develop the Arkansas Water Plan as a comprehensive program for the orderly development and management of the state's water and related land resources. ACA 15-22-503(e)(1989) requires water development projects to be in compliance with the Arkansas Water Plan.

(4) Water Transfers.

(a) Out of State. Persons wishing to transfer water out of the state, except bottled or 1984 existing municipal transfers, must apply to the Arkansas State Soil and Water Conservation Commission. The Commission will research the request and recommend to the General Assembly whether the transfer is in the public interest. No water may be so transferred without the approval of the General Assembly and without an interstate compact.

(b) To Nonriparians. The Commission may authorize upon application the transportation of excess surface water to those without riparian rights to such water under the provision of Statute 15-22-304. The statute spells out the general provisions for evaluating the request for transfer of water and the considerations which must be taken into account in determining what surface water is excess.

c. Missouri Statutes. The statutes of Missouri applicable to drought contingency are those in Section 256.400 entitled "Water Usage". This section gives the Department of Natural Resources the responsibility of maintaining a registration of the major water users of the state. The users are defined as any person, firm, corporation or the State of Missouri, its agencies or corporations or any other political subdivision of the state with a water source and the equipment necessary to withdraw or divert 100,000 gallons or more per day from any stream, river, lake, well, spring or other water source. Section 256.415 of this statute states that an unregistered water diversion is declared a nuisance and provides that the Director of the Department of Natural Resources may request the attorney general file an injunction to halt the withdrawal or diversion. Section 256.430 is very important with regard to the rights of the water users. It states that, "Nothing in Sections 71.287, RSMo, and 256.400 to 256.430 will be construed to limit the common law water rights of any person." This common law right is taken to be the riparian water right mention in paragraph 6-01.a. above.

6-02. Institutional.

a. Minimum Releases.

(1) Clearwater. The minimum flow requirement for Clearwater is 150 cfs. This is set forth in the Reservoir Regulation Manual and is based on the lowest flow rate during the period of record from which the dam was designed. Consideration with regards to this flow rate must be given to the downstream water suppliers of Piedmont and Poplar Bluff, Missouri, which draw directly from the Black River. The U.S. Fish and Wildlife Service and the Missouri Department of Conservation recommended that the minimum release be 250 cfs for the months of June, July, and August, and 200 cfs for September. The current minimum release of 150 cfs is considered adequate for the remainder of the year. These recommended releases would benefit recreational boating and fish habitat downstream of Clearwater, however, impacts to the reservoir have not been evaluated.

(2) Fisheries. The construction of the multipurpose hydroelectric projects converted the downstream fisheries from warm water native fish to cold water hatchery produced fish. During the hot summer months, May through the middle of October, minimum releases are made to maintain the required low temperature. An informal but long standing arrangement between

the Corps, SWPA, and the agencies responsible for fisheries has resulted in the specific releases in Table 5-2. These releases have, thus far, provided a survivable temperature environment.

(3) Fish Hatcheries. Another minimum release at Norfork, Table Rock, and Greers Ferry, for which there is some basis in project authorization is the fish hatchery release. The fish hatchery release structures were constructed in conjunction with the construction of the projects and their costs were included with the project's cost, implying that they are a part of the authorized project purpose. The Greers Ferry and Table Rock hatcheries require about 20 cfs and the Norfork hatchery uses about 40 cfs. Public Law 86-93, 86th Congress modified the authorization of Table Rock to include 27,000 acre-feet of storage to provide water for operation by the State of Missouri of a fish hatchery without reimbursement.

b. Table Rock Oxygen Releases. The downstream channel of Table Rock is configured such that it provides little reoxygenation of hydropower releases. For this reason the Corps has, over the years, restricted the generation rates at Table Rock as the dissolved oxygen concentration of the hypolimnion of the thermally stratified lake decreases. Studies have shown that by decreasing the generation capacity, oxygen entrainment in the turbine releases can be increased. The Corps has, by long standing precedence, attempted with the cooperation of SWPA and their customers to maintain a 4 milligram/liter dissolved oxygen level in Table Rock releases. This has provided a survivable environment for the trout.

c. SWPA Power. The Southwestern Power Administration has entered contracts to sell energy from the White River multipurpose projects. The power requirements can place release requirements that constrain flexibility of operation

6-03. State Agency Responsibilities.

a. Arkansas Soil and Water Conservation Commission. As a result of the drought of the early 1950's, this agency was established to oversee water development and conservation in Arkansas. Regulation of water resources, therefore, falls within its authority. The Commission's responsibilities include issuance of permits for dams, allocation of diversions from streams among the use of water during periods of shortage, and negotiation of interstate water compacts. It serves as a liaison with the federal government in water resource related activities and has developed the state water plan. It is the primary agency with which drought related coordination will be made within Arkansas.

b. Missouri Department of Natural Resources. This multifaceted organization encompasses most water related activities within the state. In addition to its water resource development functions it is responsible for pollution control, public drinking water, geology, dam safety, outdoor recreation, and energy development.

c. Arkansas State Health Department. This department has the responsibility for the safety of domestic water supplies. The program is administered by the agency's Division of Engineering. It approves all new water sources and water treatment facilities. The agency will be the first contacted by communities whose water systems become adversely effected by a drought. They also conduct chemical analysis of public water supplies.

d. Arkansas Department of Pollution Control and Ecology. This department has primary responsibility for state level administration of the Federal Water Pollution Act of 1976 and its amendments. In addition they are responsible for instream water quality monitoring. Other responsibilities are to classify all waters of the state according to the "uses which they are or may be put and to establish pollution standards to protect these waters from contamination or other attraction of the physical, chemical or biological properties.

e. Arkansas Industrial Development Commission. As a cabinet level agency of state government this commission is concerned with the improvement of the state's economy. In this capacity they have the responsibility of recommending when the governor will declare a drought emergency within the state.

f. Missouri Department of Conservation. This agency is responsible for the well being and development of the state fisheries. They are vitally interested in-stream water quality as it affects the fish. In the cold water fisheries below Beaver and Table Rock they are primarily interested in the temperature and the dissolved oxygen content of the water. They also operate the trout hatchery below Table Rock Dam and provide a trout stocking program.

g. Arkansas Game and Fish Commission. Established by the 35th Amendment to the state's constitution in 1944 this independent agency is responsible for management of the state's wildlife and property set aside for wildlife enhancement. Specifically with regard to water they are responsible for the state's fisheries and hatcheries. They administer the stockage of the cold water put-and-take trout fishery below the White River projects in Arkansas.

h. Arkansas State Department of Parks and Tourism. This department promotes recreation, tourism and generally administers all state parks and related facilities. As such it serves as a spokesman for the state's tourism and recreational industry.

i. Arkansas Waterways Commission. This commission is task with promotion and coordination of water transportation development and the development of river ports. In 1979 it was given the duties and responsibilities of the abolished White River Navigation District Commission. As such it serves as the state's focal point for navigation related issues regarding the White River Basin.

j. State Office of Emergency Services. This office provides for rendering of mutual aid among the political subdivisions of the state and with other states and the federal government in order to carry out emergency services. It also coordinates all disaster related activities in the state.

SECTION VII - DROUGHT MANAGEMENT PLAN.

7-01. General.

a. Concept of Plan. The Corps of Engineers, in recognition of the potential water needs that might develop during severe droughts, has developed a strategy for necessary actions and coordination keyed to remaining lake storage and drought duration. Drought and other exigencies affecting domestic, municipal and industrial water supplies will likely generate requests for water stored in Corps reservoirs. When these situations occur, the requests may require immediate action. Section 6 of the Flood Control Act of 1944 provides an opportunity to be responsive to such requests. Under the provisions of this act, the Secretary of the Army is authorized to contract with states, municipalities, private concerns, or individuals at such prices and on such terms as he may deem reasonable for domestic and industrial uses for surplus water that may be available at any reservoir under the control of the Department of the Army. The District Engineer will determine water which is deemed surplus to each project as needed to meet requests for emergency supplies. In providing surplus water, the preferred approach is for a State or subdivision to enter into a contract with the Secretary of the Army and to agree to act as wholesaler for all of the water requirements of individual users. This places the local governments in a position to help their citizens during difficult times and minimizes the potential for problems that could arise if the Secretary was to determine who was entitled to shares of surplus water based on assessments of local needs. In addition to conventional water supply needs there will also be needs for hydropower generation, fisheries, water quality, agricultural, recreation, etc. This plan addresses the Little Rock District's actions and coordination related to water management at its lakes during a drought. It should also be recognized that concurrent non-water management actions will be on-going through the Corps Natural Disaster Response Plan. The two elements of the Corps which administer the two plans work closely in those areas and in those actions which have overlappping responsibilities in a drought emergency.

b. Description of Drought Levels. To establish a control means for providing an intensified response to a worsening drought situation four drought action levels have been established. These levels as presented in Table 7-1 recognize two measures of drought severity. First, the duration of drought as measured since the PDSI receded below zero. Secondly, the elevation or zone to which the lake level has receded below the top of the conservation storage. The drought durations reflect time periods in which various types of water users are expected to be impacted. For example, agricultural users may be adversely impacted by short duration droughts of less than 12 months; water supplies based on shallow, low yield aquifers or small stream impoundments could be impacted within 24 months of drought; at durations to 36 months the water shortage may impact all but the largest streams and high yielding aquifers that are recharged

from outside the drought area. The lake elevation reflects zones in which various in-lake or release problems or restriction are expected as summarized in Plates 7-1 through 7-6. By using these two parameters the drought level will be declared in a fairly subjective manner. Level 1 will not be formally declared but the Reservoir Control Section will intensify their awareness of an impending or potential drought condition. They will make a concerted effort to keep the Chief of Engineering Division abreast of worsening conditions. Levels 2 through 4 will be declared by the District Engineer based on information and recommendations from the Chief of Engineering Division. For the Corps purposes, if the duration range of drought and pool zones coincide as presented in Table 7-1, then the drought level will be as indicated in the first column of the table. For other combinations of pool zones and duration range, a level will be estimated based on a subjective determination of the combined severity of the two measures. For example, if a drought is in its third range (24-36 months) and a pool is in its first zone (highest elevation limits), it will probably be declared a level 2 drought severity. The Corps action and coordination would then be based on a level 2 drought event. Recommended actions for all four drought levels are presented in Plates 7-7 through 7-10. Coordination requirements are presented in Chapter 8.

Table 7-1
Drought Action Levels Designations

		Pool Elevation Limits for each Drought Level					
Level	Duration (months)(1)	Beaver	Bull Shoals	Table Rock	Nor-fork	Greers Ferry	Clear-water
1(2)	0-12	1120-1105	654-640	915-900	552-538	461-448	494-491
2	12-24	1105-1093	640-635	900-890	538-530	448-443	491-488
3	24-36	1093-1083	635-632	890-885	530-515	443-438	488-484
4	>36	<1083	<632	<885	<515	<438	<484
Bottom of Conservation Pool:		1077	628.5	881	510	435	454

(1) Duration refers to the number of consecutive months that the applicable PDSI value has been below zero.
(2) Top of conservation pool is upper limit of level 1.

(1) Level 1. At this level the water managers monitor the onset of an apparent drought situation. In this level the region is in incipient drought conditions. It is identified by

the conditions specified in Table 7-1. While this is generally characterized as a mild moisture deficit it may, during the late phases have a notable effect on the agricultural community. Any drought is much more damaging to agriculture when it takes place during high water use periods or critical crop growth periods. In this level the Corps should be able to meet its water supply contractual commitments and the multipurpose lakes should not have experienced drawdowns much in excess of about 50 percent.

(2) Level 2. This level is declared by the District Engineer based on recommendations of the Chief, Engineering Division. In this phase, the agricultural industry is noticeably impacted. Vegetation is suffering moisture stress and beginning to die. Some municipal and industrial water users may have instituted conservation measures in the summer months due to high demand. The District Engineer will activate the Corps Drought Management Committee (CDMC) to assure Corps actions and responses are consistent with policy and needs in all functional areas. The membership and purpose of the CDMC is presented in paragraph 7-02.

(3) Level 3. This level is declared by the District Engineer based on recommendations from the Chief, Engineering Division. This indicates the region is verging on a severe drought condition during this level. Most district multipurpose lakes are expected to be below 30 percent remaining storage and the drought has extended now for more than 24 months. The Corps will begin a determination of surplus water availability and may consider the reduction of some downstream releases as well as encourage water conservation. Marginally developed municipal and industrial water supply sources will be having difficulty meeting demands and conservation measures will probably be instituted. Some of the smaller systems may experience complete failure and resort to hauling treated water from neighboring communities. This may generally be seen in the mountainous regions of the basin. From an agricultural standpoint the drought will be an economic disaster in many areas. Most unirrigated agriculture has failed and cattle herds are being force marketed due to feed shortages. During this phase of drought the District Engineer will activate an Inter-Agency Drought Management Committee (IDMC) as the interface between the CDMC and the water user's needs in the basin as represented by the committee members. The membership and function of this committee is presented in paragraph 7-02.

(4) Level 4. This level is declared by the District Engineer based on recommendations of the Chief, Engineering Division. A Level 4 drought condition exist when only a small percentage, usually about 10 percent, of conservation storage remains in the multipurpose projects. Severe water shortages are expected to be common throughout the region at drought durations associated with this level. By this time conditions will have worsened to the point that drawing the pools into their inactive

zones is imminent. The minimum hydropower operating level is within this zone as well as many of the lower water supply intakes. The Corps will continue to use the CDMC and the IDMC as the primary elements in decisions related to drought actions and responses. Water rationing and apportionment may be required to maintain critical water needs. The Corps and/or the State, but not necessarily the President, will have declared that an emergency situation exists.

7-02. Drought Management Committees. To assure adequate response to worsening problems as a drought increases in severity, two decision supporting committees are formed as a major part of this DCP. These committees play a vital role in sorting out priorities, justifications, and the scope of actions and responses the District will take in response to drought problems and requests. As an aid to these committees and the Corps in general, tables of recommended water conservation measures and actions are presented in Plates 7-7 through 7-10. A description of the committees follows and how they will function is presented in the following paragraphs.

a. Corps Drought Management Committee. The first of these, the Corps Drought Management Committee (CDMC), is activated by the District Engineer to meet the decision making needs of the district. The committee will be chaired by the District Engineer or his designee and will be composed of the chiefs of the Engineering, Planning, Real Estate and Construction-Operations Divisions. In addition there will be advisory representatives of the Office of Counsel, Public Affairs, Emergency Management, Hydraulics, and Safety. As needed the Chairman will invite representatives from pertinent Resident Offices and other elements to attend individual meetings. The chairman will call the committee to active status at his discretion or at the recommendation of his staff during Level 2 drought conditions. It may also be called into ad hoc session as needed for isolated problems in Level 1. The purpose of this committee is to represent the broad range of Corps and other federal interests and to evaluate and consolidate the LRD position, priorities, and justifications for water management actions that go beyond routine procedures for authorized purposes. The CDMC will decide when a determination of possible surplus water amounts is needed from Engineering Division. The committee will also assure that actions being conducted under the Corps Emergency Management function (Natural Disaster Plan) are compatible with any overlapping actions being taken under this DCP. As chairperson of the committee, the District Engineer is the approving authority for recommended actions of the committee. The technical support of the CDMC will come from the staffs of the members as required. Each will be responsible for their respective functional areas. All matters relating to water resource status and the regulation of the reservoirs will be handled through the Hydraulics Branch of the Engineering Division. Information relating to water resources or hydraulics which is received by the committee from outside agencies for

consideration regarding a requested action will be referred also to the Hydraulics Branch for evaluation by its Reservoir Control Section to ensure its sufficiency from a technical hydrologic standpoint. If coordination for additional information is required, it can be handled directly from the Reservoir Control Section to the outside agency. Technical support related to emergency operations under the Natural Disaster Response Plan (ER 500-1-1) will be provided by Emergency Management Branch. Technical support regarding water supply contracts will be provided through the Planning Division and Contracting Division. Planning Division will determine the appropriate water user charges. The actual issuance of the contract will be done through the Contracting Division. Water supply accounting will be handled similar to the contracts currently in effect. A more detailed discussion of these procedures is included in paragraph 8-02.

b. Inter-Agency Drought Management Committee. The second committee, the Inter-Agency Drought Management Committee (IDMC), is an advisory group composed of state and federal representatives that have the authority to represent all water user needs within the White River Basin. The committee is activated and chaired by the District Engineer. State members as cited in Table 7-2 and as appointed by the state Governor will represent the state's interests. They will present the states' needs with regards to operation of the Corps projects and use of water in the basin. While the state committee member(s) can be revised at the discretion of the governor, it is recommended that the member(s) be those persons with the authority within the state to set or coordinate policy regarding water resources, fish and wildlife, recreation, and navigation. Upon receipt of a notice of the committee activation; the Governors will be requested to forward committee selections not cited in Table 7-2 to the District Engineer. It is recommended that the state Governor appoint an agency from the IDMC that will serve as the state's central focus for coordination and committee representation. This lead agency will be responsible for general coordination among state agencies and with the CDMC. Federal members of the committee include the Administrator of the Southwestern Power Administration, the Director of the U.S. Fish and Wildlife Service and the District Engineer of the Little Rock District who serves as Chairman. The District Engineer will represent the interests and needs of all federal agencies except the Southwestern Power Administration and the U.S. Fish and Wildlife Service. He will maintain contact with the other federal agencies to assure their functional area interests and inputs are available in the decision making process. As needed, he will invite representative from other state and federal agencies to attend IDMC meetings. The committee will be called to active status by the District Engineer at the onset of Level 3 drought severity conditions and will continue in operation for as long as conditions are at or worse than Level 3. However, the IDMC will be called for an Ad-Hoc meeting during Level 2 conditions within 60 days of the first activation of the CDMC. This will assure early input from non-Corps interests.

Additional Ad-Hoc meetings of the IDMC will be scheduled if needed. The purpose of the IDMC is to periodically review the status of the district's lake storages and operations, review all drought related water needs and requests to establish which ones might be met by or required from Corps lakes, develop proposed action plans which seem reasonable for meeting consolidated and coordinated user needs within the basin, and set priorities on the needs and actions. These plans and priorities are provided to the CDMC as recommended actions with supporting justifications for use within the Corps' decision channels. The committee will meet in an ad-hoc session at any time or place deemed necessary by the chairman or by a representative portion of the group. For such meetings, the person initiating the meeting will be responsible for the prior distribution of the agenda. To have a representative portion, there must be representation of at least one spokesperson from each state and one from the Corps of Engineers. Meetings can be either in person or by conference telephone, but no less than one out of every three will be in person.

Table 7-2
Inter-Agency Drought Management Committee
Members (1)

Arkansas
Arkansas State Soil and Water Conservation Commission
Arkansas Department of Pollution Control and Ecology
Arkansas Department of Parks and Tourism
Arkansas Game and Fish Commission
Arkansas Waterways Commission
Arkansas Health Department
Office of Emergency Services
Missouri
Department of Natural Resources
Missouri Department of Conservation
Federal
District Engineer, Little Rock District, Corps of Enineers
U.S. Fish and Wildlife Service
Southwestern Power Administration

(1) State members may be added or deleted at discretion of the Governor.

(1) Administrative Support. The general administrative support for the IDMC will be furnished by the Little Rock District. The district will supply a meeting place suitable for the group at a location central to both states or one which alternates between the two states. Specific equipment needs, or other administrative requirements must be made known to the Corps in time to furnish the meeting room. Members will be responsible for their own travel expense. Any special request for speakers or for persons making presentations to the committee

must be submitted to the chairman or his representative in time to be worked into the meeting agenda. Administrative secretarial support on an individual basis will be the responsibility of the individual members, but preparation of the meeting report and recommendations will be handled by the Corps. All public release of information from the IDMC meetings will be handled through the Little Rock District Public Affairs Office. Meetings will be open to the public.

(2) Legal Support. Legal support for the actions and procedures within each state will come from the office of the affected state's Attorney General. Legal support for the federal agencies will come from the particular agency's office of counsel. Any technical problems arising between these offices may be coordinated between the legal counsels as needed.

(3) Technical Support. Technical support of IDMC activities will be furnished to the members by their respective agencies. This includes the evaluation of requests for assistance or of the impacts of proposed actions. Where there are conflicts within the agencies of a state, a designated primary state spokesman will voice the position the state government wishes to take. Functional levels within the agencies represented may coordinate among themselves as necessary to clarify any information received to support a request or action. Requests found technically insufficient after committee review will be returned without action. Once a request for drought related action is evaluated and is found in compliance with the IDMC policy developed for drought response it may be recommended. Such recommendations will be forwarded to the appropriate action agency for acceptance and response, typically the Corps of Engineers. Primarily the IDMC is a policy making committee. It will, therefore, rely heavily on technical support and evaluation from its technical staffs as represented by it's members.

7-03. Drought Management Procedures.

a. General. Within the concept of this plan it is recognized that there are many actions and coordination requirements which can be foreseen as the drought worsens. The point in the drought at which these actions are appropriate is determined by the drought's duration and/or the amount of water in the particular lake or lakes affected. Using the current lake elevation and the number of months the PDSI has been below zero, the corresponding actions may be selected from Plates 7-7 through 7-10. These plates present recommended conservation or special purpose actions. For example, if the northwest climatological division has had a PDSI below zero for 28 months and the Beaver pool is drawn to elevation 1090, then it would follow that Beaver is in a Drought Action Level 3. This would correspond to the actions on Plate 7-9. In using any of these plates, the user must be familiar with those actions which are suggested for the

other levels to understand the broad scope of actions possible. In general, as the conservation storage is utilized and as the drought severity increases, the impacts of the actions taken will be more severe. The column labeled "Impacts" is included to orient the reader to some of the considerations he must take into account in determining actions to be taken. These plates are not all inclusive, but provide a summary of the major actions to be considered and their resultant impacts. A column of "Coordination Requirements" is included to show the principle organizations or offices that have an interest in the action taken. The actions recommended in these charts are provided for consideration and are not intended to be automatically instituted. Any specific action taken during a drought period must specifically be designed to address the need at the time and must be tailored to minimize adverse impacts and promote the interest and welfare of the public. Section VIII has the specific requirements and chain of coordination presented by levels as a detailed guide for required minimal coordination. It is important that this coordination be made in advance of any action because of the severe impacts which will precipitate from some of these actions.

b. Level 1. The Reservoir Control Section will continue routine low flow operations but will assure other elements are aware of lake and river conditions. The Chief of Reservoir Control Section (RCS) will keep the district's division chiefs and the Chief, Water Management Branch, in SWD fully informed of project operations and the status of lake storage. The Chief of Engineering Division will advise the District Engineer of conditions which would require a declaration of Level 2 status. While in Level 1 status the Corps will consider the recommended actions specified in Plate 7-7. Requests and decisions for non-routine water management actions will be coordinated through normal Engineering Division procedures as specified in Chapter 8.

c. Level 2. The District Engineer will declare Level 2 conditions based on recomendations from the Chief, Engineering Divsion. He will activate the CDMC which will consider those Level 2 actions detailed in Plate 7-8. In addition those Level 1 actions already instituted will be continued as needed. Within 60 days of the first CDMC meeting the District Engineer will call an ad-hoc meeting of the IDMC to brief the members on the current status and outlook. Requests and actions related to non-routine water management procedures will be coordinated through the newly activated CDMC to assure the various functional elements of the district are responding in a coordinated and concerted effort. The CDMC will work with the Public Affairs Office to provide news releases as needed to keep the public updated on the general status and situation of district lakes. The Chief, Reservoir Control Section will provide technical briefings on status and possible conservation procedures as required by the chairman of the CDMC. The committee will provide the overall review for all nonroutine requests related to water releases and storage usages. Requests for water management actions received by all

functional elements will be forwarded to the CDMC for its evaluation and consolidation with other requests and action plans. The CDMC will coordinate with other district elements and state and federal agencies as indicated in Plate 8-2 to develop consolidated proposals for the Corps' response and actions related to the drought. It then provides guidance for specific objectives and priorities for Engineering Division use in developing specific action plans and deviations from the standard water management plan where possible. The Reservoir Control Section coordinates and carries out these plans and deviations through their routine command channels. CDMC requirements for non-water management actions will be coordinated and carried out by Emergency Management Branch through their Natural Disaster Plan. The Chief, Engineering Division will monitor conditions to advise the District Engineer when to declare Level 3.

d. Level 3. Based on status reports of water conditions and recommendations from the Chief of Engineering Division, the District Engineer will decide when Level 3 status has been reached. The District Engineer will declare Level 3 status and activate the Inter-Agency Drought Management Committee as the interface between the CDMC and the nonroutine or unauthorized users and needs within the basin. The IDMC will provide input on needs and actions to address drought problems. These actions may be those identified in Plate 7-9 and others developed in light of existing conditions. The IDMC consolidates the state and federal positions on drought actions needed within the basin that depend on or impact the Corps lakes. They provide the CDMC with justifications, priorities, and suggested actions which in their opinion will serve the most critical needs from the remaining lake storage and project releases. The CDMC will determine when the Chief, Engineering Division should furnish the District Engineer a recommendation on the amount of surplus water available at each project. The CDMC and other functional areas within the Corps conduct their coordination and response plans as required for Level 3 but with the benefit of input from IDMC. The Chief, Engineering Division will monitor conditions to advise the District Engineer when to declare Level 4. Basic coordination will be conducted in accordance with Chapter 8. As in previous levels the primary coordination for water management actions will be through the water management chain of command.

e. Level 4. Based on status reports of water conditions and recommendations from the Chief of Engineering Division, the District Engineer will decide when Level 3 status has been reached. In this level all needs will be analyzed closely and water will be apportioned by the CDMC only after consultation with the IDMC. It is anticipated that not all future water requests and needs will be met from the storage remaining. Minimum releases needed for downstream fisheries, wildlife, and recreation are curtailed as needed to assure priorities related to essential needs for domestic, industrial and commercial purposes are met when possible. In Level 4, actions such as those in Plate 7-10 will be considered by the CDMC and the IDMC

in addition to the actions initiated in the previous levels. As in previous levels, the Water Management and Emergency Management groups will conduct their portions of the District's actions and responses. They will maintain a close coordination between the two functions and will use the CDMC as a central focus point for primary coordination of all needs and actions.