

From: "Moorer, Tom C." <TCMOORER@southernco.com>
To: <mdn@nrc.gov>, <michael.sackschewsky@pnl.gov>
Date: 12/26/2006 11:50:01 PM
Subject: FW: Coosa River Low Flow Estimate

Barton information we discussed.

TCM

>
> _____
> **From:** Williams, Dana M.
> **Sent:** Wednesday, December 13, 2006 8:42 AM
> **To:** Moorer, Tom C.
> **Subject:** Coosa River Low Flow Estimate
>
> <<Coosa River Low Flow Estimate.pdf>>
>
> Merry Christmas!
>
> Dana Williams
> Southern Nuclear Operating Company
> Nuclear Development
> P.O. Box 1295
> Birmingham, AL 35201
> P 205.992.5934
> F 205.992.5296
>
>

Mail Envelope Properties (4591F98B.C99 : 10 : 40089)

Subject: FW: Coosa River Low Flow Estimate
Creation Date 12/26/2006 11:40:55 PM
From: "Moorer, Tom C." <TCMOORER@southernco.com>

Created By: TCMOORER@southernco.com

Recipients

nrc.gov

TWGWPO01.HQGWDO01
 mdn (Mark Notich)

pnl.gov

michael.sackschewsky

Post Office

TWGWPO01.HQGWDO01

Route

nrc.gov
 pnl.gov

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MESSAGE	497	12/26/2006 11:40:55 PM
Coosa River Low Flow Estimate.pdf		620887
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Options

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Security: Standard

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United States Department of the Interior

GEOLOGICAL SURVEY

2350 Fairlane Drive, Suite 120
Montgomery, Alabama 36116

November 28, 2001

Mr. William C. Dykes
Alabama Power Company
600 North 18th Street
P.O. Box 2641
Birmingham, Alabama 35291

Dear Mr. Dykes:

Enclosed are the following items utilized in the 7-day 10-year low-flow estimate for Coosa River near Childersburg, Alabama:

1. Spreadsheet of minimum 7-day values with dates of occurrence and ranking for period 1965-2001 for Logan Martin, Lay, Mitchell, and Jordan Dams.
2. Same spreadsheet with plotting position handwritten on it.
3. Plots of discharge vs. plotting position for Logan Martin, Lay, Mitchell, and Jordan Dams.

Daily discharges for this analysis were obtained from Alabama Power Company on a spreadsheet giving the daily turbine releases and gate or spillway spillages. This data was processed using EXCEL to compute a 7-day running average for the period of record beginning January 1, 1964 to December 31, 2000. Discharges for Logan Martin did not include the leakage flow until 1993 so a value of 650 cubic feet per second was added to the 7-day running averages prior to this date.

The 7-day values were ranked for each climatic year (ending March 31) and plotting position computed using $n=37$ years and the equation $n+1/\text{rank}$. So the lowest value for 37 years is plotted at a recurrence interval of 38 years, the 2nd lowest at 19 years, ..., and the 37th lowest at 1.03 years. This method is known as a Log-Pearson Type III distribution, which is the technique used by USGS in the determination of low-flow estimates. A hand drawn line was done because our computer program uses discharges input into our database. Since the discharges for three of the dams were not in our database it was easier to do the plots by hand.

The graphical fit of the line giving the relationship of discharge to recurrence interval demonstrates the reason that the 7-day 10-year low-flow is considered to be an estimate. It must be stated that frequency curves are based on random homogeneous data and changes in operation procedures can impact the data. An example of this is the minimum flow at Jordan Dam. The current 1-day and 3-day discharge figures have certainly been impacted and differ from those prior to 1990. A time-sampling error can occur with shorter periods of data as an extraordinary event can bias the relationship. Certainly as more years of data are obtained the fit becomes tighter and more reliable. However, the results appear to be within 100 cubic feet per second for each of the four dams.

Hopefully this explanation of the process used is adequate for your need. Let me know if further explanation is necessary.

Sincerely,

A handwritten signature in cursive script that reads "James L. Pearman". The signature is written in black ink and is positioned to the right of the typed name.

James L. Pearman
Hydrologist

Enclosure

LOGAN MARTIN				LAY DAM			MITCHELL DAM			JORDAN DAM			
YEAR	DATE	FLOW	RANK	DATE	FLOW	RANK	DATE	FLOW	RANK	DATE	FLOW	RANK	RANK
1965	21-Jul	3200	31	13-Jul	2850	23	10-Jul	3590	31	11-Jul	4000	32	
1966	1-Sep	3660	36	17-Oct	3140	29	19-Oct	3210	27	19-Oct	2900	17	
1967	31-Jul	3310	34	29-Jul	3260	30	29-Jul	3500	30	29-Jul	3840	30	
1968	18-Apr	2790	23	23-Apr	2890	25	17-Apr	3070	24	18-Apr	3230	24	
1969	12-Sep	2070	11	13-Sep	1580	6	13-Sep	1760	7	13-Sep	1710	4	
1970	22-Jul	1800	8	23-Jul	1800	10	23-Jul	2190	9	22-Jul	2320	10	
1971	10-Jul	2120	12	3-Oct	1410	5	4-Oct	1580	5	6-Oct	1550	3	
1972	13-Oct	1370	4	13-Oct	810	2	13-Oct	871	1	13-Oct	1190	2	
1973	9-Oct	2410	17	12-Oct	1920	11	6-Oct	2340	12	12-Oct	2110	7	
1974	19-Sep	2770	22	19-Sep	2190	17	19-Sep	2550	18	19-Sep	2690	15	
1975	3-Oct	893	2	2-Oct	387	1	2-Oct	894	2	2-Oct	2050	6	
1976	2-Sep	2950	27	2-Sep	3170	27	2-Sep	3830	33	2-Sep	4490	35	
1977	6-Sep	2530	20	6-Sep	2470	21	27-Nov	2750	20	27-Nov	3270	25	
1978	6-Sep	1960	9	4-Jul	1620	7	6-Sep	1690	6	5-Jul	2360	12	
1979	1-Oct	2500	19	28-Sep	2190	16	28-Sep	2540	17	10-Oct	3310	27	
1980	5-Jul	3790	37	5-Jul	3740	37	5-Jul	4570	37	5-Jul	5370	37	
1981	20-Jan	2280	14	20-Jan	2130	15	20-Jan	2710	19	20-Jan	2800	16	
1982	26-May	1480	6	27-May	1750	9	18-Aug	2080	8	18-Aug	2230	8	
1983	6-Sep	2860	24	6-Sep	3050	26	2-Sep	3020	23	2-Sep	2980	20	
1984	6-Sep	2750	21	6-Sep	2520	22	6-Sep	2820	21	5-Sep	3150	23	
1985	24-Sep	2370	16	28-Sep	1640	8	28-Sep	2210	10	26-Sep	2600	14	
1986	30-Sep	3030	29	30-Sep	3290	31	20-Sep	3180	26	18-Sep	3320	28	
1987	23-May	733	1	23-May	990	3	25-May	1520	4	17-May	1830	5	
1988	12-Aug	2410	18	12-Aug	2430	20	12-Aug	2470	14	11-Aug	2550	13	
1989	13-Jul	1240	3	15-Jul	1050	4	15-Jul	1290	3	15-Jul	1170	1	
1990	29-Apr	2950	26	14-Aug	3630	35	14-Aug	3180	25	14-Aug	3410	29	
1991	6-Jul	3210	32	4-Jul	3100	28	4-Sep	3220	28	4-Sep	3080	21	
1992	24-Sep	3180	30	24-Sep	3300	32	24-Sep	3690	32	10-Oct	3280	26	
1993	8-Aug	3450	35	8-Aug	3600	34	8-Aug	3990	34	8-Aug	4240	33	
1994	7-Nov	1610	7	12-Oct	1990	12	8-Oct	2500	15	15-Oct	2290	9	
1995	9-Jun	2940	25	8-Jun	3730	36	5-Jun	4460	36	20-Nov	4330	34	
1996	15-Sep	2370	15	15-Sep	2000	13	14-Sep	2210	11	8-Aug	2970	19	
1997	5-Sep	3230	33	5-Sep	3440	33	5-Sep	4110	35	5-Sep	4580	36	
1998	24-Sep	3030	28	24-Sep	2880	24	24-Sep	3400	29	7-Sep	3940	31	
1999	19-Oct	1400	5	6-Oct	2420	19	25-Oct	2920	22	25-Oct	2970	18	
2000	21-Sep	2240	13	22-Sep	2210	18	22-Sep	2450	13	26-Sep	3100	22	
2001	25-Jun	2060	10	29-Jun	2080	14	1-Jul	2500	16	4-Jul	2350	11	

n=37

distⁿ = $\frac{n+1}{n} = \frac{38}{1}$

1200

1250

1500

1700

added to Logan Martin for page

4650

4650

LOGAN MARTIN
DATE FLOW

LAY DAM
DATE FLOW

MITCHELL DAM
DATE FLOW

JORDAN DAM
DATE FLOW

YEAR	DATE	FLOW
1965	21-Jul	3200 -31-1.73
1966	1-Sep	3660 -36-1.66
1967	31-Jul	3310 -34-1.12
1968	18-Apr	2790 -23-1.65
1969	12-Sep	2070 -11-3.45
1970	22-Jul	1800 -8-4.75
1971	10-Jul	2120 -12-3.17
1972	13-Oct	1370 -4-9.5
1973	8-Oct	2410 -17-2.24
1974	19-Sep	2770 -22-1.73
1975	3-Oct	893 -2-1.9
1976	2-Sep	2950 -27-1.41
1977	6-Sep	2530 -20-1.9
1978	6-Sep	1960 -9-4.2
1979	1-Oct	2500 -19-2.00
1980	5-Jul	3790 37-1.03
1981	20-Jan	2280 -14-2.71
1982	26-May	1480 -6-6.3
1983	6-Sep	2860 -24-1.58
1984	6-Sep	2750 -21-1.81
1985	24-Sep	2370 -16-2.38
1986	30-Sep	3030 -27-1.31
1987	23-May	733 -1-3.8
1988	12-Aug	2410 -18-2.11
1989	13-Jul	1240 -3-12.7
1990	29-Apr	2950 -26-1.46
1991	6-Jul	3210 -32-1.19
1992	24-Sep	3180 -30-1.27
1993	8-Aug	3450 -35-1.09
1994	7-Nov	1610 -7-5.42
1995	9-Jun	2940 -25-1.52
1996	15-Sep	2370 -15-2.53
1997	5-Sep	3230 -33-1.15
1998	24-Sep	3030 -28-1.36
1999	19-Oct	1400 -5-7.6
2000	21-Sep	2240 -13-2.92
2001	25-Jun	2060 -10-3.8

DATE	FLOW
13-Jul	2850 -23-1.65
17-Oct	3140 -29-1.31
29-Jul	3260 -30-1.27
23-Apr	2890 -25-1.52
13-Sep	1580 -6-6.3
23-Jul	1800 -10-3.8
3-Oct	1410 -5-7.6
13-Oct	810 2-19
12-Oct	1920 -11-3.45
19-Sep	2190 -17-2.24
2-Oct	387 1-38
2-Sep	3170 -27-1.41
6-Sep	2470 -21-1.81
4-Jul	1620 -7-5.42
28-Sep	2190 -17-2.38
5-Jul	3740 37-1.03
20-Jan	2130 -15-2.53
27-May	1750 -9-4.2
6-Sep	3050 -26-1.46
6-Sep	2520 -22-1.73
28-Sep	1640 -8-4.75
30-Sep	3290 -31-1.23
23-May	990 3-12.7
12-Aug	2430 -20-1.7
15-Jul	1050 -4-9.5
14-Aug	3630 35-1.09
4-Jul	3100 -28-1.36
24-Sep	3300 -32-1.19
8-Aug	3600 -34-1.12
12-Oct	1990 -12-3.17
8-Jun	3730 -36-1.06
15-Sep	2000 -13-2.57
5-Sep	3440 -33-1.15
24-Sep	2880 -24-1.58
6-Oct	2420 -19-2
22-Sep	2210 -18-2.11
29-Jun	2080 -14-2.71

DATE	FLOW
10-Jul	3590 -31-1.73
19-Oct	3210 -27-1.41
29-Jul	3500 -30-1.27
17-Apr	3070 -24-1.58
13-Sep	1760 7-5.42
23-Jul	2190 9-4.2
4-Oct	1580 -5-7.6
13-Oct	871 1-38
6-Oct	2340 -12-3.17
19-Sep	2550 -18-2.11
2-Oct	894 -2-19.15
2-Sep	3833 -33-1.15
27-Nov	2751 -20-1.9
6-Sep	1690 -6-6.3
28-Sep	2540 -17-2.38
5-Jul	4570 -37-1.03
20-Jan	2710 19-2.00
18-Aug	2080 -8-4.75
2-Sep	3020 -23-1.65
6-Sep	2820 21-1.81
28-Sep	2210 10-3.8
20-Sep	3180 26-1.46
25-May	1520 -4-9.5
12-Aug	2470 -14-2.71
15-Jul	1290 -3-12.7
14-Aug	3180 -25-1.52
4-Sep	3220 -28-1.36
24-Sep	3690 -27-1.19
8-Aug	3990 -34-1.12
8-Oct	2500 -15-2.53
5-Jun	4460 -36-1.06
14-Sep	2210 -11-3.45
5-Sep	4110 -35-1.09
24-Sep	3400 -29-1.31
25-Oct	2920 -22-1.73
22-Sep	2450 -17-2.52
1-Jul	2500 -16-2.38

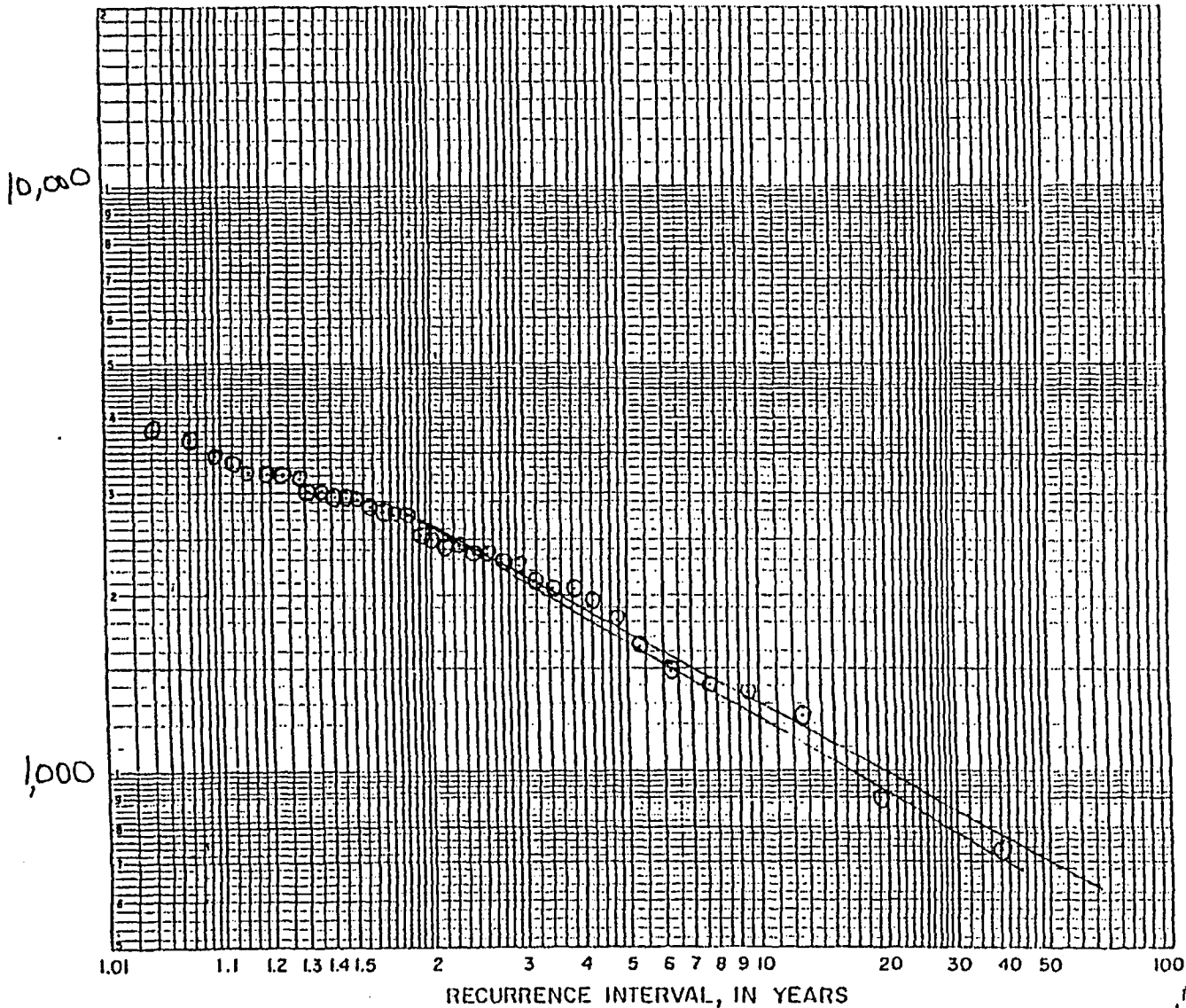
DATE	FLOW
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19-Oct	2900 -17-2.74
29-Jul	3840 -30-1.27
18-Apr	3230 -24-1.58
13-Sep	1710 -4-9.5
22-Jul	2320 -10-3.8
6-Oct	1550 -3-12.7
13-Oct	1190 -7-19
12-Oct	2110 7-5.42
19-Sep	2690 15-2.53
2-Oct	2050 -6-6.3
2-Sep	4490 -25-1.09
27-Nov	3270 25-1.52
5-Jul	2360 -12-3.17
10-Oct	3310 -27-1.41
5-Jul	5370 -37-1.03
20-Jan	2800 -16-2.38
18-Aug	2230 -8-4.75
2-Sep	2980 -20-1.65
5-Sep	3150 -23-1.71
26-Sep	2600 -14-2.71
18-Sep	3320 28-1.36
17-May	1830 -5-7.6
11-Aug	2550 -13-2.92
15-Jul	1170 -1-2.8
14-Aug	3410 -29-1.31
4-Sep	3080 -21-1.81
10-Oct	3280 -26-1.46
8-Aug	4240 -33-1.15
15-Oct	2290 9-4.2
20-Nov	4330 -34-1.12
8-Aug	2970 -19-2.00
5-Sep	4580 -36-1.06
7-Sep	3940 -31-1.23
25-Oct	2970 -18-2.11
26-Sep	3100 -22-1.73
4-Jul	2350 -11-3.45

Drainage area mi²

- Logan 7740
- Chilhowee 8390
- Lay 9050
- Mitchell 9780
- Jordan 10,100

Logan Martin Dam

Use 1200 cfs

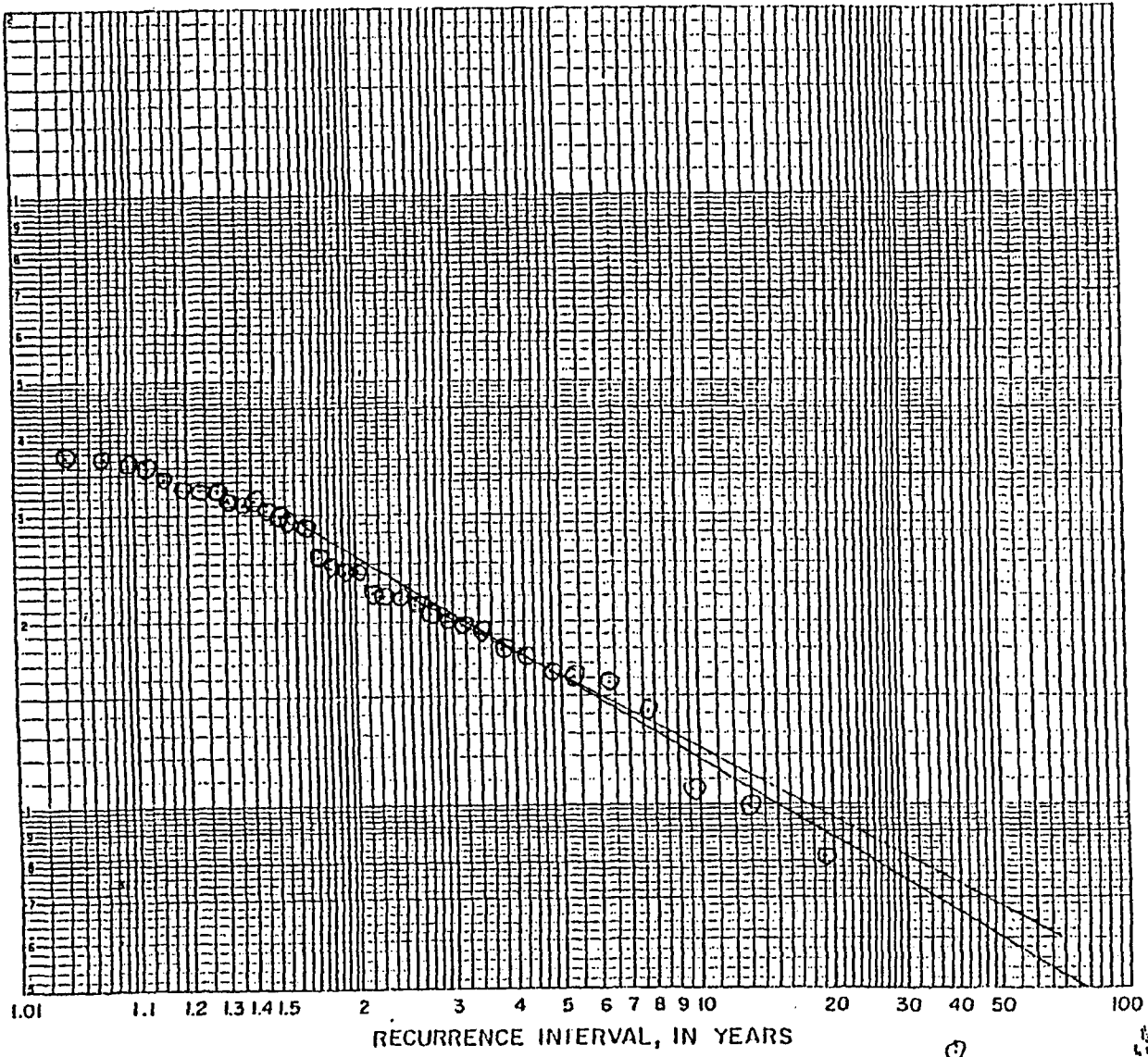


Lay Dam

use 1250 cfs

10,000

1,000

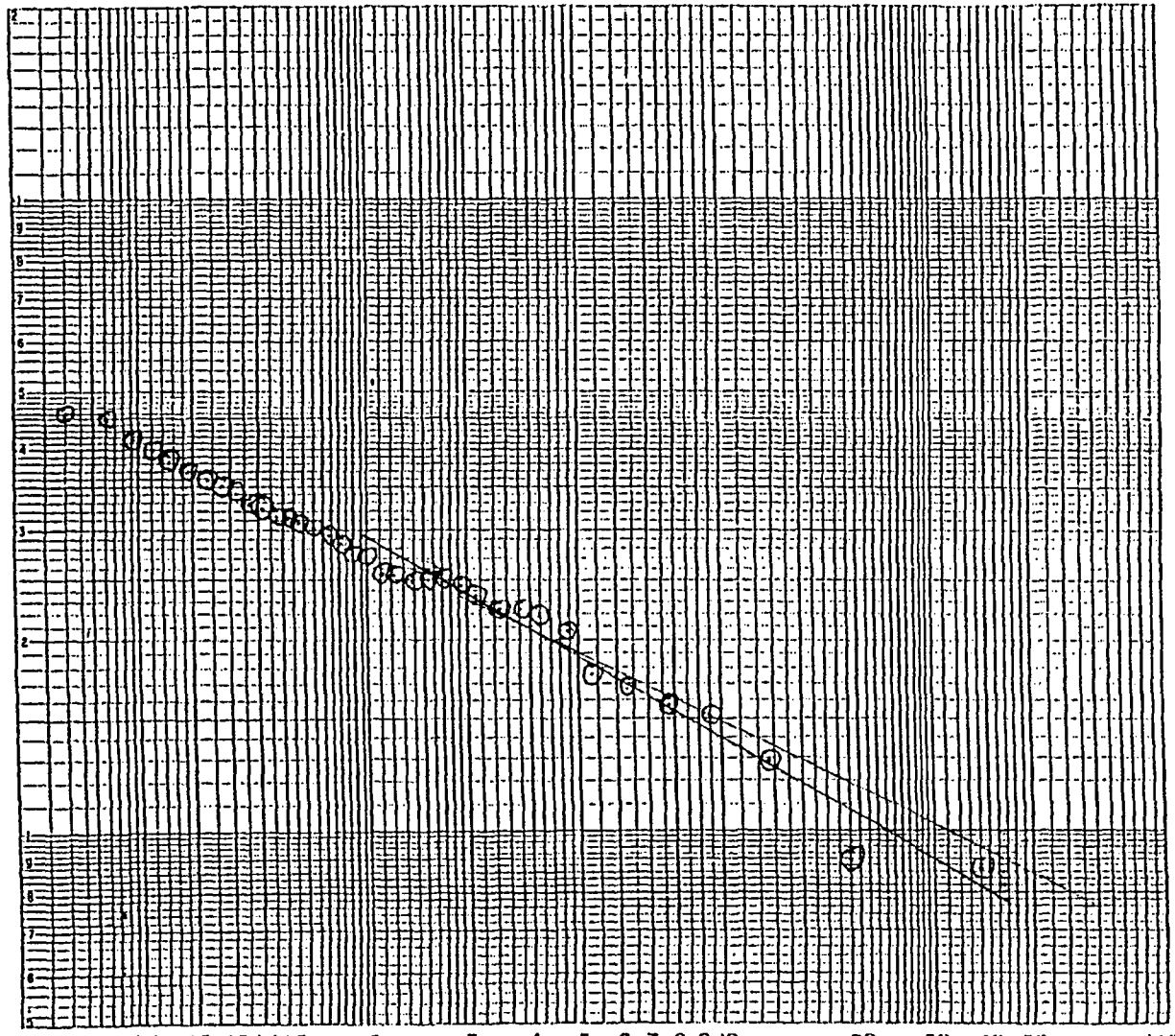


Mitchell Dam

use
1500 cfs

10,000

1,000



1.01 1.1 1.2 1.3 1.4 1.5 2 3 4 5 6 7 8 9 10 20 30 40 50 100

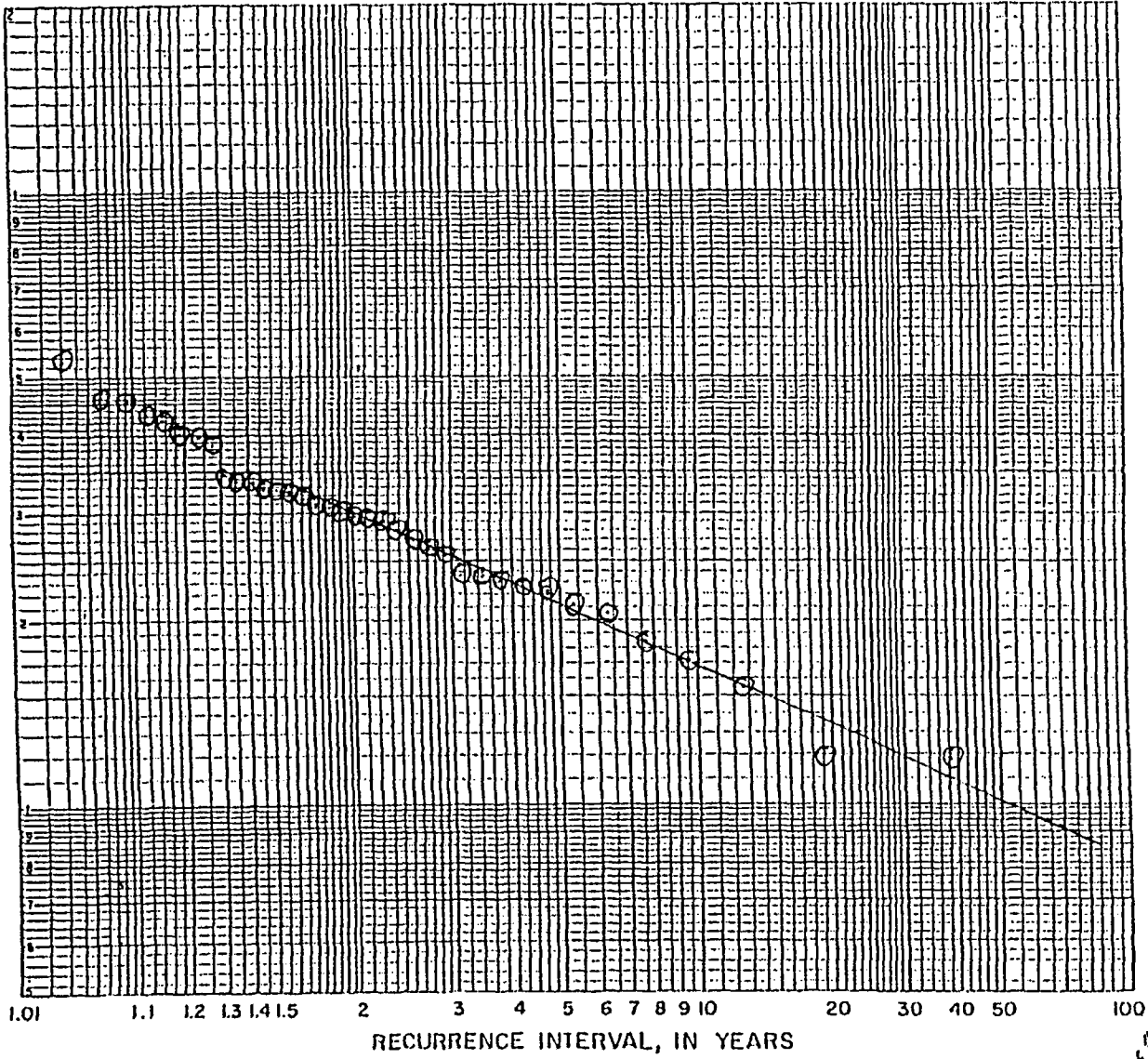
RECURRENCE INTERVAL, IN YEARS

Jordan Dam

Use
1700 cfs

10,000

1,000



Moorer, Tom C.

From: Dykes, William C.
Sent: Monday, November 13, 2006 4:25 PM
To: Moorer, Tom C.
Cc: Stover, Charles M.; Graham, Stacey A.
Subject: RE: Hydro Budget Average Flows at Mitchell and Jordan
Attachments: USGS November 28 2001 Letter on 7Q10 on the Coosa River.pdf

Tom,

Attached are 7Q10 determinations for APC's reservoirs on the Coosa River. These 7Q10 flows were determined by the USGS in 2001. For Mitchell and Jordan, the 7Q10 flows are 1,500 cfs and 1,700 cfs respectively.

From the 2006 Hydro Budget, the 2005 average flow at Mitchell is 13,914 cfs (88% of average) and the 2005 average flow at Jordan/Bouldin is 13,941 cfs (92% of average). The actual flows recorded in 2005 at both Mitchell and Jordan/Bouldin are within a ¼ of a percentage point when compared with 2006 Hydro Budget flow values for 2005.

Bill Dykes
Southern Company Generation
Hydro Services

Ph: (205) 257-3585
 SoLINC Local: (205) 438-8072
 SoLINC Toll Free: (888) 325-1593
 SoLINC Radio: 10*10018

From: Moorer, Tom C.
Sent: Monday, November 13, 2006 2:58 PM
To: Dykes, William C.
Cc: Stover, Charles M.; Graham, Stacey A.
Subject: RE: Hydro Budget Average Flows at Mitchell and Jordan

Thanks, Bill. This is exactly what I needed. Do we have a 7Q10 or other statistical measurement offlow available? Also, how does the 2005 average compare with other water years? Is it a high, low, or average year?

TCM

From: Dykes, William C.
Sent: Monday, November 13, 2006 2:52 PM
To: Moorer, Tom C.
Cc: Stover, Charles M.; Graham, Stacey A.
Subject: Hydro Budget Average Flows at Mitchell and Jordan

Tom,

From Reservoir Management's 2006 Hydro Budget, the average daily flows are as follows:

Mitchell 15,733 cfs

11/13/2006

Jordan/Bouldin 16,386 cfs

Jordan 6,538 cfs
Bouldin 9,848 cfs

Please call or email if wish to discuss or need further information.

Take care,

Bill Dykes
Southern Company Generation
Hydro Services
Ph: (205) 257-3585
SoLINC Local: (205) 438-8072
SoLINC Toll Free: (888) 325-1593
SoLINC Radio: 10*10018