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A COMPILATION OF WATER TEMPERATURES NEAR
GRAND COULEE DAM AND IN ENVIRONS OF LAKE ROOSEVELT

By

Harry A. Kramer

HANFORD ATOMIC PRODUCTS OPERATION
GENERAL ELECTRIC COMPANY
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INTRODUCTION

This tabulation of data collected since 1952 by the author was made in response to a request by the Atomic Energy Commission. It is understood it is to be transmitted to the Bureau of Reclamation for their information. The data are to afford basic information to support the Bureau's decision in regard to a third power house at Grand Coulee Dam.

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SECTION 1.1

DESCRIPTION OF READING LOCATIONS AND
METHODS OF MEASUREMENT

The readings in Section 1.2 were taken six miles below Grand Coulee Dam at the U.S.G.S. gage location. The readings were taken by various people connected with the U.S.G.S. In some instances where we had asked for the reading, the samples of water were dipped by bucket from a point one foot below the surface. We do not know how other samples were taken. Thermometers used were furnished by the U.S.G.S. and ourselves.

The readings shown in Section 1.3 were taken by the writer or by persons he had trained. Samples were dipped by bucket from the north shore and insofar as possible represented temperatures one foot below the surface. Thermometers were checked against certified instruments.

The temperatures shown in Section 1.4 above Grand Coulee Dam near North Marina were taken by local engineers or by the writer. The samples were dipped samples (one foot below the lake surface).

SECTION 1.2

RIVER TEMPERATURES SIX MILES BELOW GRAND COULEE DAM
1952 - 1958Accuracy $\pm 2.0^{\circ}\text{F}$

Date	$^{\circ}\text{F}$
July 31, 1952	64
October 24, 1952	50
December 9, 1952	58
January 21, 1953	38
June 19, 1953	51
August 9, 1953	61
August 15, 1953	64
July 13, 1954	54
September 24, 1954	65
January 18, 1955	35
August 9, 1955	61
August 18, 1955	59
August 25, 1955	61
August 31, 1955	57
September 14, 1955	58
October 6, 1955	59
October 14, 1955	60
October 20, 1955	60
October 27, 1955	43
November 5, 1955	56
December 29, 1955	37
May 24, 1956	47
June 6, 1956	53
June 21, 1956	51
June 28, 1956	57
June 24, 1957	52
November 14, 1957	55
January 29, 1958	41
March 13, 1958	44
April 29, 1958	45
May 21, 1958	56

SECTION 1.3

RIVER TEMPERATURES ONE-FOURTH MILE BELOW
GRAND COULEE DAMAccuracy $\pm 0.5^{\circ}\text{C}$

Date	$^{\circ}\text{C}$	Date	$^{\circ}\text{C}$
<u>1952</u>		<u>1953</u>	
January 16	5.2	January 15	5.8
February 24	3.6	February 17	4.9
March 20	3.9	February 23	5.0
April 20	6.1	March 12	4.9
May 20	9.2	March 14	4.9
June 20	13.4	April 20	7.2
July 29	17.6	May 16	9.6
August 22	17.8	June 12	11.8
September 18	18.0	July 30	16.6
October 6	17.8	August 12	18.0
November 4	14.1	September 15	17.9
December 18	5.5	October 13	17.6
		November 13	12.2
		December 14	7.5
<u>1954</u>		<u>1955</u>	
January 10	6.8	January 20	5.2
February 2	4.0	February 14	3.2
March 3	3.0	March 14	2.6
April 6	5.0	April 10	4.8
May 14	9.8	May 9	8.2
June 23	11.0	June 18	12.8
July 18	13.8	July 18	13.5
August 30	16.2	August 20	16.3
September 24	16.3	September 16	16.2
October 15	14.5	October 23	15.6
November 12	12.0	November 14	8.5
December 9	8.8	December 22	4.2
<u>1956</u>		<u>1957</u>	
January 14	4.8	January 28	2.4
February 8	2.1	February 20	1.8
March 10	2.1	March 15	2.7
April 4	4.2	April 10	3.8
May 5	8.5	May 10	8.7
June 3	11.7	June 14	12.2
July 18	16.0	July 11	15.8
August 24	18.2	August 17	17.2
September 17	18.1	September 18	16.8
October 4	16.0	October 30	14.6
November 15	11.6	November 13	12.2
December 10	7.2	December 19	7.2

SECTION 1.4

LAKE TEMPERATURES ABOVE GRAND COULEE DAM
NEAR NORTH MARINA

Dip Samples	
Date	°C
July 4, 1952	19.4
September 1, 1952	20.2
July 7, 1953	20.8
July 1, 1954	18.9
August 16, 1954	18.7
July 4, 1955	20.2
July 10, 1956	21.0
June 30, 1957	19.1

SECTION 2.1

DESCRIPTION OF READINGS

The thermocline readings in Section 2.2 were taken by lowering a copper constantan thermocouple to various depths and reading millivolts on a laboratory type instrument (accuracy $\pm 0.1^{\circ}\text{C}$). Many tests were made to determine the best location for readings.

The readings in Section 2.3 were taken by Canadian engineers and are dip samples. The original thermometers were checked against certified instruments and are accurate to $\pm 0.1^{\circ}\text{C}$.

The readings shown in Section 2.4 were taken by representatives of the Bureau of Reclamation or by the author or under his direction. The thermometers used were "certified" and were accurate to $\pm 0.1^{\circ}\text{C}$.

SECTION 2.2

THERMOCLINES AT GRAND COULEE DAM

Accuracy $\pm 0.1^{\circ}\text{C}$

Elevation Ft. msl	$^{\circ}\text{C}$					
	July 29	Aug. 8	Aug. 18	1958 Aug. 29	Sept. 4	Sept. 9
1290	20.0	20.6	21.8	21.9	21.9	21.9
1285	19.6	20.0	20.8	21.6	21.8	21.7
1280	17.8	19.4	20.2	21.3	21.6	21.6
1265	17.8	18.6	19.6	20.7	21.1	21.4
1235	17.8	18.6	19.4	20.2	20.9	20.9
1185	15.8	16.3	17.9	19.0	19.8	19.8
1135	15.0	15.8	17.3	18.7	18.8	19.4
1035	15.0	15.5	16.3	17.2*	17.6	17.8
910	15.0	15.5	15.6	17.4	17.6	17.7

* Temperature fluctuating.

SECTION 2.3

WATER TEMPERATURES ABOVE GRAND COULEE DAM
IN CANADAAccuracy $\pm 1^{\circ}\text{F}$

August 1, 1958		Kootenay at Slocan River		[°] F At Brilliant	Robson at Castlegap
3 PM	Depth 6 In.	64		68	59
	Depth 5 Ft.	66		68	59
11 PM	Depth 6 In.	64		68	59
	Depth 5 Ft.	66.6		68	59

SECTION 2.4

DAILY TEMPERATURES AT GRAND COULEE DAM

Accuracy $\pm 0.2^{\circ}\text{F}$

Date	Temp. of Discharge Over Spillway	Temp. of Discharge 1035' Level	Temp. at Bridge Below Grand Coulee Dam			Temp. at U.S.G.S Gage Below Grand Coulee Dam	
			Max.	Min.	Avg.		
1958							
7/25	----	59.0				10 PM	64.6
7/26	----	59.0					
7/27	----	59.0					
7/28	----	59.0					
7/29	68.0	59.0				10 PM	64.2
7/30	67.6	59.0	63.7	62.0	62.5		
7/31	67.7	59.1	62.6	59.3	61.6		
8/1	67.8	59.2	62.6	60.7	62.2	7 PM	63.0
8/2	67.9	59.3	63.1	60.3	62.5		
8/3	68.0	59.4	63.7	60.6	62.5		
8/4	68.0	59.5	64.1	62.1	63.2		
8/5	68.1	59.6	63.1	62.7	62.8		
8/6	68.2	59.8	62.4	61.6	65.2		
8/7	68.3	60.0	62.2	61.1	61.5		
8/8	68.5	60.1	62.3	61.2	61.9	8 PM	63.0
8/9	68.6	60.2	62.6	61.1	61.7		
8/10	68.8	60.4	62.9	60.8	62.1		
8/11	68.9	60.5	63.1	61.0	62.0		
8/12	69.1	60.7	63.6	61.4	62.4		
8/13	69.2	60.8	63.6	61.5	62.6		
8/14	69.3	60.9	63.5	62.0	62.7		
8/15	69.5	61.1	64.0	62.4	63.2		
8/16	69.6	61.2	64.0	63.1	63.6		
8/17	69.8	61.4	64.2	62.3	63.4		
8/18	69.9	61.5	65.3	61.8	63.7	Noon	63.0
8/19	70.1	61.6	64.8	62.8	63.8		
8/20	70.3	61.7	65.0	62.8	63.7		
8/21	70.4	61.8	64.4	63.0	64.6		
8/22	70.6	61.9	65.0	62.8	64.1		
8/23	70.8	62.0	65.0	63.5	64.3		
8/24	71.0	62.0	65.1	62.9	64.3		
8/25	71.2	62.1	66.4	63.6	64.5		
8/26	71.4	62.2	65.4	63.7	64.4		
8/27	71.5	62.3	65.3	63.3	64.2		
8/28	71.6	62.4	66.7	63.0	64.4	1 PM	63.0
8/29	71.7	62.5	66.4	62.2	64.3	Noon	63.0
8/30	71.6	62.6	66.7	63.6	64.9		
8/31	71.5	62.7	66.4	63.9	63.6		
9/1	71.5	62.8	68.3	64.4	65.1		
9/2	71.4	62.9	66.9	63.7	65.0		
9/3	71.4	63.0	67.4	63.3	65.2		

SECTION 3.1

DESCRIPTION OF READINGS

The thermocline readings shown in Section 3.2 were taken by the writer or under his direction. Readings were obtained by lowering a copper constantan thermocouple to various depths and measuring millivolts on a laboratory instrument (accuracy $\pm 0.1^{\circ}\text{C}$).

The Canadian readings in Section 3.3 were from dipped samples taken and measured by Canadian engineers.

The temperatures in Section 3.4, "Temperatures Near Gifford", were dipped samples taken and measured by local residents. Thermometers used were checked with certified instruments and readings were accurate to less than 0.5°F .

The temperature shown in Section 3.5, "River Temperatures Near Mouth of Spokane River", were taken by Washington Water Power engineers especially for the writer.

The readings shown in Sections 3.6 and 3.7 were taken by Bureau of Reclamation employees or by the writer or under his direction. Instruments used were certified thermometers accurate within $\pm 0.1^{\circ}\text{C}$.

SECTION 3.2

THERMOCLINES AT GRAND COULEE DAM

Accuracy $\pm 0.1^{\circ}\text{C}$

Elevation Ft. msl	$^{\circ}\text{C}$ 1959						
	July 30	Aug. 12	Aug. 18	Sept. 11	Sept. 22	Sept. 1	Sept. 2
1290	20.4	20.1	21.6	20.8	19.0		
1285	19.7	19.9	19.9	19.9	18.1		
1280	17.3	19.0	19.1	19.8	18.0		
1265	16.9	17.5	18.3	18.6	17.2		
1235	15.5	16.4	17.2	18.4	17.1		
1185	14.8	16.4	17.0	17.8	16.6		
1135	14.3	16.0	16.4	17.3	16.1		
1035	13.5	15.7	15.8	16.4	15.7		
910	--	--					
Temp. Below Bridge	--	16.2	15.9	16.6	16.6	15.8	16.4

SECTION 3.3

WATER TEMPERATURES ABOVE GRAND COULEE DAM
IN CANADA

		°F		
Date		Below #5 Power- house Kootenay	Columbia at Castlegar Ferry	Below Waneta Dam
Aug. 18	Surface	62	59	--
	4 Ft. Deep	--	58	--
Aug. 25	Surface	59	59	66
	4 Ft. Deep	--	59	66
Sept. 1	Surface	58	58	65
	4 Ft. Deep	58	58	65
Sept. 9	Surface	59	57	60
	4 Ft. Deep	59	57	60
Sept. 14	Surface	59	58	--
	4 Ft. Deep	59	58	--
Sept. 22	Surface	56	58	56
	4 Ft. Deep	56	58	50
Sept. 29	Surface	54	55	54
	4 Ft. Deep	54	54	54

SECTION 3.4

LAKE TEMPERATURES NEAR GIFFORD, WASHINGTON

°F			°F		
Date	Morning	Afternoon	Date	Morning	Afternoon
<u>1959</u>			<u>1959</u>		
Sept. 1	61.0	61.0	Nov. 28	45.0	
2	62		29	44	
3	62		30	44	
4	61				
5	61		Dec. 1	44	
6	61.0	61.0	2	44	
7			3	44	
8			4	44	
9			5	43	
10	60.4	60.4	6	42	42.0
11			7	41	42.0
12			8	40	42.0
13			9	39	42.0
14			10	39	42.0
15	60.6		11	39	41.0
16			12	39	41.0
17			13	39	
18			14	39	
19			15	39	
20			16	39	
21	59		17	39	
22		59.0	18	39	
23			19	39	
24	58.5	58.5	20	39	
25			21	39	
26			22	39	
27	57.8	57.8	23	39	
28			24	39	
29			25	39	
30	57.0	57.0	26	39	
			27	39	
			28	39	
			29	39	
			30	39	
			31	39	

SECTION 3.5

RIVER TEMPERATURES NEAR MOUTH OF SPOKANE RIVER

Date		°C
<u>1959</u>		
August 1	1 PM	20
2		19
3		19
4		20
5		18
6		20
7		19
8		19
9		19
10		19
11		19
12		20
13		18
14		19
15		19
16		18
17		17
18		18
19		19

SECTION 3.6

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1959

All Temperatures in °C

Date	September						October				
	1 AM	5 AM	9 AM	3 PM	5 PM	8 PM	1 AM	5 AM	9 AM	5 PM	8 PM
1							16.0	15.9	16.0	15.8	15.8
2							15.8	15.8	15.9	15.8	15.8
3							15.8	15.8	15.8	15.8	15.8
4							15.7	15.7	15.7	15.8	15.8
5							15.8	15.8	15.7	15.7	----
6							15.7	15.7	15.7	15.7	15.7
7							15.6	15.7	15.6	15.6	15.5
8							15.6	15.6	15.6	15.5	15.5
9							15.5	15.5	15.5	15.3	15.3
10							15.3	15.3	15.3	15.3	15.3
11		16.6	16.9			16.9	15.3	15.2	15.3	15.2	15.2
12	16.9	16.9	16.9			16.9	15.2	15.2	15.2	15.1	15.1
13	16.8	16.8	16.8			16.8	15.1	15.2	15.0	15.0	15.0
14	16.8	16.8	16.7			16.8	15.1	15.0	----	14.9	14.9
15	16.8	16.8	16.6			16.8	14.8	14.8	----	14.8	14.8
16	16.8	16.8	16.8			16.8	14.8	14.8	14.7	14.7	14.7
17	16.8	16.8	16.8		16.8	16.7	14.7	14.8	14.7	14.7	14.7
18	16.8	16.9	16.9			16.8	14.7	14.7	14.6	14.6	14.6
19	16.8	16.8	16.8		16.7	16.7	14.6	14.6	14.5	14.5	14.5
20	16.8	16.8	16.7		16.7	16.7	14.6	14.4	14.3	14.4	14.4
21	16.7	16.7	16.6	16.7	16.6	16.6	14.3	14.3	14.2	----	14.1
22	16.5	16.5	16.5	16.5	16.7	16.7	14.1	14.1	----	14.1	14.0
23	16.7	16.5	16.6		16.7	----	14.0	14.0	14.2	14.0	14.0
24	16.6	16.6	16.6	16.6	16.7	16.7	14.1	14.1	13.9	13.9	13.9
25	16.6	16.6	16.6		16.6	----	13.8	13.8	13.8	13.7	13.7
26	16.6	16.6	16.5		16.5	16.5	13.7	13.7	13.7	13.7	----
27	16.5	16.5	16.4		16.3	16.3	13.7	13.7	13.6	13.5	13.5
28	16.3	16.3	16.2		16.3	16.3	13.5	13.5	13.4	13.2	13.4
29	16.3	16.3	16.2		16.2	16.2	13.4	13.4	13.2	13.2	13.2
30	16.2	16.2	16.1	16.1	16.1	16.0	13.4	13.3	13.1	13.2	----
31							13.2	13.2	13.1	13.2	13.2

SECTION 3.6

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1959

All Temperatures in °C

Date	November						December					
	1 AM	5 AM	9 AM	5 PM	8 PM	9 PM	1 AM	5 AM	9 AM	5 PM	7 PM	9 PM
1	13.1	13.1	13.1	13.1			9.3	9.3	9.3	9.4		9.4
2	13.0	13.0	13.1	12.9	12.9		9.2	9.2	9.2	9.1		9.1
3	12.9	12.9	12.9	12.8	12.8		9.1	9.1	8.9	8.9		8.9
4	12.8	12.7	12.5	12.6	12.6		8.9	8.8	8.8	8.8		---
5	12.6	12.6	12.5	12.6	12.6		8.7	8.7	8.7	8.6		---
6	12.5	12.5	12.4	12.4	12.4		8.7	8.6	8.7	8.6		8.6
7	12.6	12.6	12.3	12.4	12.4		8.6	8.6	8.5	8.5		8.5
8	12.2	12.2	12.2	12.1	12.1		8.5	8.5	8.4	8.4		---
9	12.1	12.1	12.1	12.1	12.1		8.3	8.3	8.3	8.1		---
10	12.0	12.0	11.9	11.9	11.9		8.2	8.2	8.1	8.0		---
11	11.9	11.9	11.9	11.8	11.8		8.2	8.2	8.1	7.8		7.8
12	11.7	11.7	11.8	11.7	11.7		7.8	7.8	7.9	7.7		---
13	11.6	11.5	11.7	11.4	11.4		---	7.8	---	7.6		---
14	11.5	11.5	11.6	11.4	11.4		---	7.8	---	7.7		---
15	11.4	11.4	11.6	11.2	11.2		---	7.7	---	7.4		---
16	11.2	11.2	11.1	11.1	11.1		---	7.6	---	7.5		7.5
17	11.1	11.1	11.0	10.9	10.9		---	7.6	7.3	7.3		7.3
18	10.4	10.4	10.8	10.9		10.9	7.3	7.3	7.2	---		---
19	10.6	10.6	10.6	10.6		10.6	7.1	7.1	7.0	---		---
20	10.6	10.6	10.5	10.5		10.5	7.0	7.0	6.9	7.0		---
21	10.5	10.4	10.4	10.3		---	6.8	6.8	6.9	6.8		6.8
22	10.3	10.3	10.3	10.3		10.3	6.8	6.8	6.8	6.7		---
23	10.2	10.2	10.2	10.1		10.1	6.8	6.7	6.7	---		---
24	10.1	---	10.1	---		10.1	6.5	6.5	6.5		6.5	
25	10.0	10.0	10.1	10.0		---	6.3	6.3	6.3		6.4	
26	9.9	10.0	9.8	9.9		---	6.3	6.3	6.3		6.1	
27	10.0	9.9	9.8	9.8		---	6.0	6.0	6.0		5.9	
28	9.7	9.7	9.6	9.6		---	5.9	5.9	5.9		6.0	
29	9.7	9.6	9.6	9.5		9.5	5.9	5.9	5.9		5.9	
30	9.5	9.5	9.4	9.4		---	5.9	5.9	5.9		5.9	
31							5.9	5.9	5.9		5.8	

SECTION 3.7

WATER TEMPERATURES BELOW GRAND COULEE DAM

Date	°C	Date	°C
August 7	17.8	September 1	17.5
8	17.5	2	17.3
9	17.5	3	17.2
10	17.5	4	17.3
11	17.3	5	17.3
12	17.4	6	17.5
13	17.3	7	17.6
14	17.1	8	17.6
15	17.0	9	17.7
16	17.2	10	17.9
17	16.8	11	17.7
18	17.2	12	17.5
19	16.9	13	16.9
20	17.0	14	17.0
21	17.3	15	17.0
22	17.2	16	17.2
23	17.3	17	17.7
24	17.4	18	18.2
25	17.4	19	18.4
26	17.2	20	18.3
27	17.0	21	18.8
28	17.3	22	18.3
29	17.0	23	18.2
30	17.0	24	18.1
31	17.2	25	18.2
		26	18.0
		27	18.0
		28	17.9
		29	18.1
		30	18.3
		October 1	18.5

SECTION 4.1

DESCRIPTION OF READINGS

The thermocline readings, Section 4.2, represent measurements taken by lowering a copper constantan thermocouple to various depths and reading millivolts on a laboratory instrument. Readings were accurate to $\pm 0.1^{\circ}\text{C}$.

The temperature readings from Canada, Section 4.3, were taken by Canadian engineers. These were dipped samples.

The readings in Section 4.4 are readings taken by local residents near Gifford. The samples were dipped from one foot below lake surface. The thermometers used had been tested and were accurate to $\pm 0.5^{\circ}\text{C}$.

The temperatures taken near Keller Ferry were readings taken by local residents. Samples were dipped from one foot below lake surface and temperatures measured with certified thermometers (accuracy $\pm 0.1^{\circ}\text{C}$).

The temperatures taken near the North Marina shown in Section 4.6 were measured by certified thermometers and were accurate to $\pm 0.1^{\circ}\text{C}$. These readings were taken by the author or by Forest Service personnel.

The readings shown in Section 4.7 were taken by Washington Water Power engineers.

The data shown in Sections 4.8 and 4.9 were taken by the writer or by Bureau of Reclamation employees at his request (accuracy $\pm 0.1^{\circ}\text{C}$).

SECTION 4.2

THERMOCLINES AT GRAND COULEE DAM

Elevation Ft. msl	°C			
	1960			
	July 29	Aug. 15	Sept. 2	Sept. 20
1290	24.2	21.5	21.8	20.0
1285	22.9	21.0	19.6	18.6
1280	22.7	21.0	18.4	18.1
1265	20.0	21.0	18.4	18.0
1235	16.8	19.1	18.3	18.0
1185	15.8	17.8	17.8	17.9
1135	15.8	17.6	17.7	17.3
1035	15.7	16.8	16.5	15.2
910	14.5	15.3	----	15.1

SECTION 4.3

WATER TEMPERATURES ABOVE GRAND COULEE DAM
IN CANADA

1960	° F		
Date	Below #5 Power- house Kootenay	Columbia at Castlegar Ferry	Below Waneta Dam
Aug. 10			
1 Ft. Below Surface	65	62	74
4 Ft. Below	--	61	--
Aug. 15			
1 Ft. Below Surface	64	61	74
4 Ft. Below	--	61	74
Aug. 23			
1 Ft. Below Surface	59	56	69
4 Ft. Below	--	56	69
Aug. 30			
1 Ft. Below Surface	63	60	--
4 Ft. Below	--	60	--
Sept. 1			
1 Ft. Below Surface	--	--	65
4 Ft. Below	--	--	65
Sept. 18			
1 Ft. Below Surface	63	62	66
4 Ft. Below	63	61	60
Sept. 22			
1 Ft. Below Surface	62	62	64
4 Ft. Below	62	61	64
Sept. 29			
1 Ft. Below Surface	60	60	61
4 Ft. Below	60	59	60.5

SECTION 4.4

LAKE TEMPERATURES NEAR GIFFORD, WASHINGTON

°F					
Date	January	March	April	May	June
<u>1960</u>					
1	39	35 Broken Ice	41	50	50
2	39	35 " "	41	50	51
3	39	35 " "	42	49	52
4	39	35 " "	43	49	52
5	39	35 " "	44	49	52
6	39	36	45	49	52
7	38	35	45	50	52
8	36	35	45	50	53
9	35	35	45	50	54
10	34	35	45	50	54
11	33	35	45	49	54
12	Lake Frozen	34	44	48	54
13	"	34	44	48	54
14	"	34	44	48	54
15	"	34	44	48	54
16	"	34	44	48	54
17	"	34	44	48	54
18	"	34	46	48	54.5
19	"	36	45	48	54
20	"	37	44	48.5	53
21	"	38	44	48.2	52
22	"	38	44	48.2	54
23	"	38	44	48.2	56
24	"	37	44	48.5	57
25	"	37	44	48.5	54
26	"	37	45	48.5	54
27	35 Broken Ice	37	46	48	54
28	35 " "	37	47	48	54
29	35 " "	38	46	48	54
30	35 " "	39	45	49	54
31	35 " "	40			

SECTION 4.4

LAKE TEMPERATURES NEAR CLEFORD, WASHINGTON

°F

Date	July	August	September	October	November	December
<u>1960</u>						
1	54	66	64	61	53	45
2	54	66	64	61	53	45
3	56	65	64	61	53	44
4	56	66	64	60	52	44
5	57	67	64	60	52	44
6	58	68	64	59	52	44
7	60	68	64	59	52	44
8	61	68	65	59	52	43
9	62	67.5	64	58	51	43
10	62	67.5	64	58	50	43
11	62	67	65	58	50	42
12	61	65	64	58	50	42
13	61	65	64	58	49	41
14	61	64	64	57	49	41
15	61	63.8	64	57	49	40
16	63	64	63	57	48	40
17	64	65.2	63	57	48	40
18	65	--	63	57	48	40
19	65	--	62	57	48	40
20	65	64	62	57	47	40
21	65	64	61	56	47	40
22	66	64	61	56	47	40
23	67	63.5	61	56	46	39
24	68	64	61	55	46	39
25	68	64	61	55	46	39
26	68	64	61	54	46	39
27	69	64	61	54	45	39
28	69	64	61	54	45	39
29	69	63	61	54	45	38
30	68.5	65	61	54	45	38
31	68					38

SECTION 4.5

LAKE TEMPERATURES NEAR KELLER FERRY

°C

Date	August	September	October	November	December
<u>1960</u>					
1		18.9	17.8	14.5	10.9
2		18.6	17.9	14.3	10.8
3		18.5	17.6	14.1	10.7
4		18.4	17.7	14.1	10.5
5		18.4	17.2	14.1	10.3
6		18.5	17.0	14.0	10.2
7		18.4	16.9	13.6	10.0
8		18.4	16.7	13.4	10.0
9		17.7	16.6	13.4	9.9
10		18.1	16.5	13.4	9.7
11	22.0	18.2	16.8	13.3	9.7
12	21.4	18.5	16.3	13.0	9.6
13	20.5	18.6	16.3	12.9	9.5
14	20.5	18.6	16.2	12.8	9.4
15	18.6	19.1	16.1	12.6	9.2
16	19.1	19.2	15.8	12.5	9.2
17	20.5	18.8	15.9	12.4	9.1
18	20.3	18.7	15.9	12.4	9.0
19	20.0	18.6	15.9	12.3	9.0
20	20.1	17.8	15.8	12.0	8.9
21	19.4	17.8	15.8	11.9	8.8
22	19.1	17.8	15.8	11.8	8.8
23	19.3	17.7	15.7	11.8	8.7
24	19.0	18.0		11.6	8.6
25	19.1	18.0		11.5	8.6
26	18.9	18.0		11.4	8.5
27	18.8	18.1		11.2	8.4
28	18.6	18.1		11.0	8.3
29	18.3	18.0	15.1	11.0	8.1
30	19	18.1	14.9	11.0	8.0
31	18.6	18.1	14.7		7.7
			14.5		

SECTION 4.6

LAKE TEMPERATURES ABOVE GRAND COULEE DAM
NEAR NORTH MARINA

1 Ft. Below Surface

Date	°C			
	August	September	October	November
<u>1960</u>				
1	22.8 (4 PM)	18.6	17.5	
2	22.8	20.55		
3	23.6	19.5	17.2	
4	23.4	18.0	17.8	14.5
5	22.6	18.2	17.4	
6	23.1	18.5	17.0	
7	22.8	----		
8	22.6	----		
9	23.0	----		
10	22.8	----		
11	23.6	----	15.9	
12	22.6	----	16.6	
13	21.7	----		
14	20.8	----	16.2	
15	20.0	18.2		
16	21.3	----		
17	22.1	----		
18	22.1	----	16.5	
19	21.6	----		
20	20.7	----		
21	19.8	----		
22	20.4	----		
23	20.3	----		
24	19.9	----		
25	19.7	----		
26	19.5	----	15.7	
27	19.0	17.5		
28	18.8	----		
29	18.7	----		
30	18.5	17.2 (9:45 AM)		
31	18.3			

SECTION 4.7

RIVER TEMPERATURES NEAR MOUTH OF SPOKANE RIVER

°C

Date	August	September	October	November
<u>1960</u>				
1	19	17(1 PM)	16	12
2	18	17	16	12
3	19	17	16	12
4	19	18	16	12
5	22	16	16	11
6	19	17	16	11
7	19	18	16	11
8	21	17	15	11
9	21	18	15	11
10	21	18	14	10
11	20	17	14	10
12	19	18	14	10
13	19	19	14	9
14	19	18	14	9
15	19	17	14	
16	19	17	14	
17	20	18	14	
18	19	17	14	
19	18	17	13	
20	18	16	13	
21	18	16	13	
22	19	16	13	
23	18	16	13	
24	17	16	13	
25	18	17	13	
26	18	15	13	
27	18	16	13	
28	18	16	12	
29	18	16	12	
30	17	16	14	
31	18		12	

SECTION 4.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1960

All Temperatures in °C

January							
Date	1 AM	5 AM	6 AM	9 AM	10 AM	5 PM	8 PM
1	5.7	5.7		5.6		5.5	
2	5.5	5.5			5.4	5.4	
3	5.4	5.4		5.4		5.4	
4	5.4	5.4		5.4		5.4	
5	5.2	5.2		5.0		5.2	
6	5.3	5.3			5.4	5.1	
7	5.1	5.1		5.2		5.1	
8	5.1	5.1		5.2		5.3	
9	5.0	5.0		5.1		5.0	5.0
10	5.5	5.3		5.1		4.9	4.9
11	4.8		4.8	4.8		4.8	4.8
12	4.8	4.8		4.8			
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

SECTION 4.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1960

All Temperatures in °C

February									
Date	1 AM	5 AM	9 AM	10 AM	11 AM	12 AM	5 PM	8 PM	11 PM
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24						2.3		2.2	
25	2.4	2.4			2.4			2.1	
26	2.4	2.2	2.3				2.1	2.1	
27	2.3	2.3		2.3			2.2	2.2	
28	2.2	2.2	2.2				2.1		2.1
29	2.0	2.0		2.0			2.1		

SECTION 4.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1960

All Temperatures in °C

March										
Date	1 AM	5 AM	8 AM	9 AM	10 AM	1 PM	4 PM	5 PM	8 PM	9 PM
1	2.1	2.1		2.0			1.8			1.8
2	1.8	1.8			1.8			1.8		1.8
3	1.8	1.8		1.8		1.8		1.9		1.8
4	2.0	2.0		1.8				1.8		2.0
5	2.0	2.0		2.0				2.0		2.1
6	2.0	2.0		2.1				2.1		2.1
7	2.0	2.0		1.9				1.9		2.0
8	2.1	2.1		2.1				1.9		1.9
9	2.1	2.1		2.0				2.0		1.9
10	2.2	2.2		2.0				1.8		1.9
11	2.1	2.1		2.1				1.9		1.9
12	2.1	2.1		2.0				2.0		1.9
13	2.1	2.1		2.0				1.9		1.9
14	2.0	2.0		2.3				2.0		2.1
15	2.2	2.2		2.0				2.0		2.0
16	2.1			2.6				2.4		2.4
17	2.1	2.1		2.0				2.3		2.2
18	2.2	2.2			2.2			2.4		2.4
19	2.2	2.2		2.2				2.4	2.4	
20	2.3	2.3		2.2				2.4	2.4	
21	2.3	2.3		2.3				2.6	2.6	
22	2.3	2.3		2.4				2.5	2.5	
23	2.4	2.4		2.4				2.6	2.6	
24	2.4	2.4		2.4				2.6	2.6	
25		2.8	2.6					2.8	2.8	
26	2.8	2.8	2.7					2.8	2.8	
27	3.5	3.5		2.8				2.9	2.9	
28	2.9	2.9	2.8					3.0	3.0	
29	3.0	3.0		3.0				3.1		
30	3.1	3.1	3.1					3.2		
31	3.2			3.2				3.3	3.3	

SECTION 4.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1960

All Temperatures in °C

May										
Date	1 AM	2 AM	5 AM	6 AM	7 AM	9 AM	4 PM	5 PM	8 PM	9 PM
1			7.5			7.5		7.3		7.2
2	7.6		7.6			7.2		7.2		
3	7.6					7.2		7.2		
4	7.2		7.2			7.3		7.2		
5	7.2		7.2			7.3		7.2		
6	7.2		7.2			7.2		7.4		
7	7.4		7.3			7.2		7.3		
8	7.2					7.2		7.2		
9	7.2			7.2		7.2		7.2		
10	7.2		7.2			7.1	7.2			
11	7.2			7.2		7.2		7.2		
12										
13		7.2				7.2		7.2	7.3	
14	7.3			7.3		7.3		7.4	7.4	
15	7.3					7.3		7.3	7.3	
16	7.4							7.5	7.5	
17	7.4				7.4			7.4	7.4	
18	7.6		7.6			7.6		7.6	7.6	
19	7.9		7.7			7.8		7.8	7.8	
20	8.2		8.2			8.1		8.2	8.2	
21	8.3		8.3			8.3		8.5		8.5
22	8.9		8.9			8.9		8.9		
23		8.8	8.8			9.0		9.0		
24	8.9		8.9			9.0		9.1		
25	9.2		9.2			9.3		9.6		
26	9.3		9.3			9.4		9.6		
27	9.4		9.4			9.5		9.4		
28	9.5		9.5			9.4	9.4			
29	9.5		9.5			9.7		9.6		
30	9.7		9.7			9.6	9.5			
31	9.5		9.5			9.7		9.7		

SECTION 4.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1960

All Temperatures in °C

June									
Date	1 AM	2 AM	5 AM	9 AM	1 PM	2 PM	3 PM	4 PM	5 PM
1	9.6		9.6	9.7					9.8
2	9.8		9.8	9.7					9.8
3	9.9		9.9	9.8					9.9
4	9.9		9.9	9.9					9.9
5	9.9		9.9	9.8	10.0				
6	10.0		10.0	10.0				10.0	
7	10.0			10.0		10.0		10.0	
8	10.0							10.1	
9	10.2		10.2	10.2			10.2	10.2	
10	10.2			10.2				10.4	
11	10.2			10.2					10.3
12	10.3			10.6		10.6			10.6
13	10.5			10.6	10.6				10.7
14	10.5			10.8			10.8		10.9
15	10.6			10.9					11.0
16	10.9			11.1					11.1
17	11.0			11.3					11.2
18	11.5			11.6					11.6
19	11.6			11.7					11.8
20	11.7			11.9					11.8
21	11.9			12.0			12.0		
22	12.0			12.1			12.0		
23	12.2			12.5					12.2
24	12.2			12.4					12.3
25	12.3			12.3				12.4	
26	12.3			12.4					12.4
27		12.4		12.4					12.4
28		12.4		12.5					12.5
29	12.4			12.5					12.5
30	12.4			12.5					12.4

SECTION 4.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1960

All Temperatures in °C

July							
Date	1 AM	5 AM	9 AM	1 PM	4 PM	5 PM	9 PM
1	12.4		12.5			12.5	
2	12.4		12.5			12.5	
3	12.4		12.4			12.5	
4	12.5		12.4			12.5	12.5
5	12.5		12.5		12.6		
6	12.6	12.6	12.6		12.6		
7	12.8	12.8	12.7				
8	12.7	12.7	12.9			13.0	
9	13.0		13.0		13.0		
10	13.2		13.1		13.1		
11	13.2		13.2			13.3	
12	13.3		13.4			13.3	
13	13.4		13.4			13.4	
14	13.6		13.6	13.6		13.5	
15	13.6		13.9			13.85	
16	13.6		13.8			13.7	
17	13.8		13.8				
18	13.8		13.8			14.4	
19	13.9		14.2			14.3	
20	14.0		14.2			14.2	
21	14.3		14.4			14.3	
22	14.3		14.7			14.4	
23	14.3		14.4			14.4	
24	14.3		14.4			14.7	
25	14.7		14.8	14.8		14.7	
26	14.7		14.9	14.9		15.1	
27	15.0		15.0	15.0		15.0	
28	15.1		15.1	15.1		15.1	
29	15.3		15.1	15.1	15.2		
30	15.1	15.1	15.2	15.2		15.2	
31	15.3		15.3	15.3			

SECTION 4.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1960

All Temperatures in °C

August									
Date	1 AM	5 AM	9 AM	1 PM	4 PM	5 PM	6 PM	9 PM	10 PM
1	15.2		15.3	15.3		15.2			
2	15.3		15.3	15.3		15.3			
3			15.2	15.2	15.2				
4	15.3		15.3	15.3		15.3			
5	15.4		15.3	15.3		15.5			
6	15.5		15.2			15.4			
7	15.4		15.2			15.6			
8	15.8		15.7			15.8			
9	15.6		15.6			15.5			
10	15.8		15.5			15.7			
11			15.8			15.8			
12	15.9	15.9	16.0			15.8			
13	16.0	16.0	15.9			15.9			
14	15.9	15.9	16.0			16.1			15.8
15	16.2	16.2	15.8		15.9			15.9	
16	15.8	15.8	15.9			16.1		16.1	
17	15.9	15.9	16.1			16.0			
18	16.2	16.2	16.4	16.4		16.0			16.5
19	16.2	16.2	16.0			16.4		16.1	
20	16.7		16.4			16.0			16.4
21	16.5		16.6				16.3		16.3
22	16.4		16.4			16.3			16.4
23	16.5		16.8			16.4			16.7
24	16.5		16.4			16.7			
25	16.4		16.7			16.7			
26	16.8		17.0			16.6			
27	16.8		16.8			16.8			
28	17.0		17.0			16.7			
29	16.5		16.5			16.7			
30	16.9		17.1			17.2			
31	16.8		16.9			17.1			

SECTION 4.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1960

All Temperatures in °C

September

Date	1 AM	2 AM	5 AM	6 AM	9 AM	10 AM	1 PM	2 PM	4 PM	5 PM	6 PM	7 PM	9 PM
1	16.9				16.9			16.9		16.9			
2	16.8				16.8					17.0			
3	16.8				17.0					16.8			
4	16.9				17.0					16.8			
5	16.9				17.2					16.9			
6	16.9				16.9					17.0			
7	17.1				17.1		17.1			17.3			
8	17.3				17.3		17.3			16.8			
9	16.7				17.1		17.1			17.1			
10	16.8				17.2		17.2			17.2			
11	16.9		16.9		17.2		17.2			17.2			
12	16.9				17.2		17.2			17.2			
13	17.1			17.0			17.0				17.1		
14	17.1				17.1		17.1				17.1		
15	17.2				17.2		17.2					17.1	
16	17.1		17.1		17.0		17.0			17.0			
17	16.9				17.0						17.1		
18	16.9			16.9	17.0					16.9			
19		16.8			16.9					16.8			
20	16.7				16.9				16.9				
21	16.8		16.8		16.7					16.8			16.8
22	16.7		16.7		16.7					17.0			16.8
23	16.7		16.7		16.6					16.7			
24	16.7		16.7		16.6					16.7			
25	16.7		16.7			16.8				16.7			16.7
26	16.7		16.7		16.7				16.6				16.7
27	16.6		16.6			16.5				16.6			16.5
28	16.5		16.5			16.5			16.6				16.5
29	16.5		16.5		16.5					16.5			
30	16.5		16.5		16.5					16.5			

SECTION 4.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1960

All Temperatures in °C

October													
Date	1 AM	2 AM	5 AM	6 AM	8 AM	9 AM	1 PM	2 PM	4 PM	5 PM	6 PM	8 PM	9 PM
1	16.5					16.5			16.4				
2	16.4					16.5				16.5			
3	16.4					16.5			16.5				
4	16.4					16.5				16.5			
5	16.4					16.4							
6						16.4				16.4			
7	16.4					16.4				16.4			
8	16.3					16.3				16.4			
9	16.3					16.3				16.3			
10	16.4					16.4					16.4		
11	16.4									16.4			
12	16.5									16.4			
13	16.4					16.3							
14	16.4												
15	16.4					16.4		16.5		16.6			
16	16.5				16.5			16.4		16.4			
17	16.4					16.4				16.4			
18	16.4									16.4			
19	16.3					16.3	16.3			16.4			
20	16.3					16.3	16.3			16.3			
21	16.2					16.2	16.2			16.3			16.3
22	16.2					16.2	16.2			16.2			
23	16.1				16.0					16.2			
24	16.1	16.0				15.9				16.0			
25	15.9					15.9				15.8			
26	15.8					15.8				15.7			
27	15.5					15.6						15.5	
28		15.4		15.4		15.5				15.5			
29	15.5					15.3				15.3			
30						15.2				15.3			15.3
31	15.3					15.2				15.4			

SECTION 4.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULÉE DAM - 1960

All Temperatures in °C

November

Date	1 AM	5 AM	8 AM	9 AM	3 PM	4 PM	5 PM	9 PM
1	15.1						15.3	
2	15.0			14.9			14.9	
3	15.0	15.0		14.9			14.8	
4	14.7	14.7		14.8			14.8	
5	14.7			14.8			14.7	
6	14.7			14.7			14.5	
7	14.5			14.5			14.4	
8	14.4						14.4	
9	14.3			14.3			14.3	
10	14.3			14.3	14.2			14.2
11	14.2			14.1			14.1	
12	14.0			14.0		13.9		
13	13.9			13.9		13.8		
14				14.1		13.5		
15	13.6			14.0			13.6	
16	13.5			13.6			13.4	
17	13.4			13.5				
18	13.2			13.1	13.1			
19	12.9			13.0			13.0	
20	12.8			12.9			12.8	
21	12.7			12.7			12.6	
22	12.5			12.7			12.7	
23	12.5							
24	12.5			12.4			12.3	
25	12.3			12.0			12.1	
26	12.2			12.2			11.9	
27	11.9			11.9			11.9	
28	11.6		11.7				11.7	
29	11.5		11.5				11.5	
30	11.4			11.4			11.5	

SECTION 4.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1960

All Temperatures in °C

December												
Date	1 AM	5 AM	6 AM	8 AM	9 AM	1 PM	3 PM	4 PM	5 PM	6 PM	9 PM	12 PM
1	11.3				11.2				11.3			
2	11.0				11.1				11.0			
3	11.0				10.9				11.0			
4	10.8	10.8			10.8				10.7			
5	10.7	10.7			10.6	10.6			10.7			
6	10.7	10.7			10.6							
7	10.5	10.5			10.5					10.5		
8	10.4	10.4			10.4				10.4			
9	10.2	10.1			10.2				10.3			
10	10.0	10.0			9.9				10.0			
11	10.0	10.0			9.8		9.9					
12	9.7	9.7			9.8				9.7			
13	9.5		9.5		9.5				9.6			
14	9.6				9.5				9.4			
15	9.4				9.4				9.2			
16	9.2				9.4				9.2			9.1
17	9.1				9.3				9.2			
18	9.0				9.1				9.0		9.0	
19	9.0				9.0				9.0			
20	8.9				8.7				8.7			
21	8.7			8.6					8.6			
22	8.5				8.5				8.5		8.4	
23	8.4				8.5				8.4			8.2
24	8.2				8.3				8.2			
25	8.1				8.1				8.1			
26	8.0				8.0			8.1				
27	8.1				7.9				7.8			7.8
28	7.8				7.9				7.6			
29	7.6				7.7				7.6			
30	7.5				7.8				7.5			
31	7.4				7.4			7.3				

SECTION 4.9

WATER TEMPERATURES BELOW GRAND COULEE DAM

°C			
Date	August	September	October
<u>1960</u>			
1	20.1	16.1	17.2
2	19.5	16.7	17.0
3	19.6	17.4	16.7
4	19.5	17.9	17.7
5	19.0	18.2	17.5
6	19.1	17.8	17.2
7	19.4	17.7	16.7
8	19.5	17.1	16.9
9	19.3	17.3	17.0
10	18.7	17.9	
11	18.1	17.8	
12	17.6	17.7	
13	18.3	18.0	
14	18.2	17.7	
15	17.8	17.7	
16	16.5	17.9	
17	16.5	18.0	
18	16.2	18.4	
19	16.2	18.2	
20	15.8	18.2	
21	15.5	17.9	
22	15.4	17.7	
23	15.5	17.7	
24	15.8	17.8	
25	15.2	17.9	
26	15.9	17.3	
27	17.0	16.8	
28	17.8	16.7	
29	15.5	16.8	
30	15.1	16.9	
31	15.3	16.8	

SECTION 5.1

DESCRIPTION OF READINGS

The thermoclines shown in Section 5.2 were from measurements made by lowering a copper constantan thermocouple to various depths and measuring millivolts on a laboratory instrument (accuracy $\pm 0.1^{\circ}\text{C}$).

The water temperature readings from Canada, Section 5.3, were taken by Canadian engineers.

The lake temperature readings near Gifford and Keller Ferry were taken by local residents using dipped samples from one foot below the lake surface. Thermometers were checked against certified instruments.

The lake temperatures from near the North Marina were from dipped samples one foot below lake surface (accuracy $\pm 0.1^{\circ}\text{C}$).

The lake temperatures at the 1035' level were from readings taken by Bureau of Reclamation employees using certified thermometers (accuracy $\pm 0.1^{\circ}\text{C}$).

SECTION 5.2

THERMOCLINES AT GRAND COULEE DAM

Elevation Ft. msl	°C						
	7/13/61	7/29/61	8/4/61	8/11/61	8/18/61	8/31/61	9/13/61
1290	23.3	22.9	26.0	26.8	27.8	22.6	24.2
1285	22.5	22.1	23.8	26.2	25.6	22.6	23.0
1280	18.8	21.9	23.8	23.8	24.5	22.6	21.0
1265	18.0	21.6	23.8	23.8	22.9	22.1	20.1
1235	15.6	17.7	19.1	19.3	19.4	19.9	20.0
1185	15.6	17.5	18.0	18.1	19.0	19.4	19.6
1135	14.6	17.2	17.5	18.1	18.1	18.2	19.6
1035	14.5	15.8	17.2	17.2	17.4	18.1	18.4
910	14.5	14.8	----	15.8	15.7	16.2	----

SECTION 5.3

WATER TEMPERATURES ABOVE GRAND COULEE DAM
IN CANADA

		°F		
Date		Below #5 Power- house Kootenay	Columbia at Castlegar Ferry	Below Waneta Dam
1961				
July 8	1 Ft. Deep	64	62.5	73
	4 Ft. Deep	--	62.0	--
July 20	1 Ft. Deep	66	63.0	75
	4 Ft. Deep	--	62.5	--
July 25	1 Ft. Deep	65	64	73
	4 Ft. Deep	--	63	--
July 28	1 Ft. Deep	66.5	64	74
	4 Ft. Deep	--	63	--
Aug. 1	1 Ft. Deep	67	64	74
	4 Ft. Deep	--	63	--
Aug. 4	1 Ft. Deep	67.5	65	74
	4 Ft. Deep	--	64	--
Aug. 9	1 Ft. Deep	68	66	74
	4 Ft. Deep	--	65.5	--
Aug. 15	1 Ft. Deep	68	65.5	74
	4 Ft. Deep	--	64.5	--
Aug. 22	1 Ft. Deep	70	66	75
	4 Ft. Deep	--	65.5	--
Aug. 30	1 Ft. Deep	70	65	74
	4 Ft. Deep	--	64	--
Sept. 1	1 Ft. Deep	62	60.5	73
	4 Ft. Deep	--	61.0	--

SECTION 5.4

LAKE TEMPERATURES NEAR GIFFORD, WASHINGTON

°F											
Date	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov. Dec.
1961											
1	38	35	39		49	51	59	70			41
2	38	36			50	53		72			
3	38	37				53		73	68		51
4	37							74			
5	36				49		61	74	67		50
6	36						62	75			
7	38		39	45	48		62	72			
8	37				50	54		69	66		
9	37							69			40
10	37				50	54		69			
11	37						66		65		
12	37				50		66	68			38
13	37				49	54		69			
14	37				49			70	65		
15	37				50	54					
16	37	37			50	54	67	69			
17	37				50						37
18	37				50			68	64	58	
19	37		42		50		66	69			44
20	37				52	57	70			56	
21	37				52	57	72				
22	37		41		50		70		62		
23	36					57	70	69		55	36
24	36		42	49	54	58	68		62		
25	35				51		68	69			
26	35	38			51	58	67				
27	35	38			51	56	68				
28	35	39	44		51			61		54	43
29	34					59	66				
30	35			49			67			52	35
31	35				54						

SECTION 5.5

LAKE TEMPERATURES NEAR KELLER FERRY

°C

Date	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1961												
1	7.7	4.2	3.0	6.3	9.3	12.8	15.3	23.0	----	----	----	----
2	7.5	4.1	3.1	6.3	9.3	13.0	15.4	23.1	----	17.9	14.5	----
3	7.5	4.0	3.1	6.3	9.1	12.9	15.5	23.2	----	----	----	10.3
4	7.4	3.8	3.2	6.2	9.0	12.8	15.5	23.2	----	----	----	----
5	7.4	3.7	3.2	6.2	9.0	12.9	15.6	23.5	----	17.5	----	----
6	7.4	3.5	3.3	6.2	9.2	12.8	15.5	23.3	----	----	14.0	----
7	7.4	3.5	3.3	6.3	9.4	12.9	15.8	23.0	----	----	----	10.0
8	7.4	3.5	3.3	6.3	9.7	13.0	15.9	23.2	20.9	----	----	----
9	7.4	3.5	3.3	6.4	9.8	13.0	16.2	----	----	----	13.0	----
10	7.3	3.4	3.4	6.4	9.8	13.1	17.1	----	----	----	----	----
11	7.2	3.5	3.5	6.5	9.9	13.2	17.8	----	20.0	17.0	----	9.0
12	7.0	3.2	3.5	6.6	10.3	13.2	18.5	----	----	----	----	----
13	7.0	3.0	3.6	6.8	10.5	13.3	19.4	----	----	----	12.7	----
14	6.9	3.0	3.6	6.9	10.9	13.3	20.3	23.6	----	----	----	8.6
15	6.9	3.0	3.7	7.1	11.5	13.4	20.0	----	----	----	----	----
16	6.8	3.0	3.7	7.3	11.4	13.5	19.9	----	----	16.8	----	----
17	6.7	3.0	3.8	7.5	11.4	13.6	19.7	----	----	----	12.2	----
18	6.5	3.0	3.9	7.5	11.0	13.8	21.5	23.2	----	----	----	8.0
19	6.2	3.0	3.9	7.5	10.8	13.9	22.5	----	----	16.4	----	----
20	6.0	3.0	4.0	7.5	10.5	14.3	22.4	----	----	----	11.6	----
21	5.9	3.0	4.1	7.6	10.2	14.7	22.5	23.0	19.2	----	----	7.7
22	5.8	3.0	4.3	7.7	10.0	14.9	22.5	----	----	----	----	----
23	5.6	3.0	4.5	7.8	10.0	15.2	23.1	----	----	15.8	11.1	----
24	5.5	3.0	4.5	8.0	10.0	15.3	23.0	22.9	----	----	----	----
25	5.3	3.0	4.6	8.3	10.1	15.5	23.1	----	18.8	----	----	7.4
26	5.1	3.0	4.8	8.4	10.5	15.6	23.0	----	----	15.3	----	----
27	5.0	3.0	5.0	8.5	10.8	15.2	23.1	----	----	----	10.5	----
28	4.8	3.0	5.4	8.6	11.0	15.2	23.1	22.9	18.4	----	----	7.0
29	4.6	----	5.9	8.8	11.4	15.2	23.2	----	----	----	----	----
30	4.4	----	6.5	9.1	11.8	15.2	23.8	----	----	15.0	10.5	----
31	4.3	----	6.4	----	12.3	15.3	23.3	----	----	----	----	6.7

SECTION 5.6

LAKE TEMPERATURES NEAR NORTH MARINA

°C						
Date	July	Aug.	Sept.	Oct.	Nov.	Dec.
<u>1961</u>						
1	23.0	23.5	22.8	18.7	-----	-----
2	22.4	23.9	-----	-----	-----	-----
3	22.5	24.3	-----	-----	14.9	-----
4	22.4	24.4	23.1	-----	-----	-----
5	23.0	23.5	-----	18.6	14.9	-----
6	23.2	22.2	-----	-----	-----	10.4
7	23.6	22.8	22.8	-----	14.7	-----
8	22.9	23.8	-----	18.4	-----	-----
9	22.5	22.7	-----	-----	14.3	-----
10	22.0	23.2	22.4	-----	14.1	-----
11	21.5	24.9	-----	-----	13.8	-----
12	21.6	24.7	-----	17.9	13.7	-----
13	22.2	23.2	21.9	-----	-----	-----
14	22.9	24.8	-----	-----	-----	-----
15	23.4	22.8	-----	-----	-----	-----
16	19.7*	22.9	21.1	-----	-----	-----
17	20.8	23.2	-----	17.5	-----	-----
18	21.4	24.0	19.5	-----	-----	-----
19	22.2	23.8	19.6	-----	-----	-----
20	23.3	23.7	19.3	-----	-----	-----
21	23.7	23.2	19.1	17.0	12.6	-----
22	23.7	23.6	-----	-----	12.4	-----
23	22.2	23.5**	-----	16.6	-----	-----
24	23.7	26.1	-----	-----	-----	-----
25	23.8	23.6	19.2	-----	-----	-----
26	23.5	23.5	19.1	-----	-----	-----
27	23.5	23.5	-----	15.8	-----	-----
28	22.2	23.8	-----	15.8	-----	-----
29	23.1	23.8	-----	15.7	-----	-----
30	22.1	23.6	-----	15.5	-----	-----
31	23.0	-----	-----	15.0	-----	-----

* Very high winds all day.

** Windy.

SECTION 5.7

WATER TEMPERATURES NEAR MOUTH OF SPOKANE RIVER

°C

Date	July	August	September	October
<u>1961 (1 AM)</u>				
1	19	19	17	15
2	19	20	17	15
3	19	19	17	14
4	19	20	18	14
5	20	22	19	14
6	18	19	18	14
7	21	19	19	14
8	18	20	18	14
9	19	19	18	14
10	18	23	18	14
11	21	20	19	14
12	23	20	19	13
13	19	19	19	13
14	19	19	18	13
15	19	23	18	
16	19	23	17	
17	18	23	17	
18	20	19	17	
19	20	20	17	
20	19	19	17	
21	19	19	16	
22	19	19	16	
23	20	24	16	
24	24	20	16	
25	20	19	16	
26	20	19	16	
27	23	19	15	
28	19	18	15	
29	19	18	15	
30	19	18	15	
31	20	18	15	

SECTION 5.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1961

All Temperatures in °C

January						
Date	1 AM	6 AM	8 AM	9 AM	3 PM	4 PM 5 PM 6 PM
1	7.3			7.3		7.3
2	7.2			7.2		7.0
3	7.1			7.2		7.0
4	7.2			6.9		7.2
5	6.9					7.0
6	6.8					6.8
7	6.8		7.0			6.7
8	6.5		6.8			6.5
9	6.5		6.5			7.0
10	6.5		7.0		7.0	
11	6.7			6.8		6.9
12	6.5			6.9		7.1
13	6.4			6.5		
14	6.4			6.3		6.5
15	6.4			6.2		6.8
16	6.1	6.1		6.0	6.2	
17	6.3			6.2		
18	6.1			6.1	6.1	
19	5.6			6.0		6.0
20	5.9			5.9		
21	5.9			5.9		5.9
22	5.9			5.8		
23	5.5			5.4		
24	5.6			5.6		
25	5.5	5.5				
26	5.5			5.7		
27	5.3			5.5		
28	5.2			5.5		
29	5.0			5.3		
30	5.1			5.3		
31	5.0			4.9	5.0	

SECTION 5.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1961

All Temperatures in °C

February

Date	1 AM	5 AM	8 AM	9 AM	1 PM	4 PM	5 PM	6 PM	9 PM
1	5.0								
2	5.0			5.2					5.2
3	5.2			4.9		5.2			
4	5.3			4.8		4.8			
5	4.8			4.8		5.2	5.2		
6	4.9			5.0			4.7		
7	4.8			4.7			4.4		
8	4.7	4.7		4.8			4.3		
9	4.5			4.3			4.0		
10	4.3			4.2			3.7		
11	4.0			4.0			3.8		
12	3.8			3.8			3.6		
13	3.6						3.7		
14	3.6			3.7			3.5		
15	3.4		3.6	3.5			3.6		
16	3.4			3.4			3.4		
17	3.4			3.4			3.4		
18	3.4			3.3			3.3		
19	3.4						3.5		
20	3.4						3.5		
21	3.4			3.3			3.4		
22	3.3			3.3			3.2		
23	3.3			3.3			3.2		
24	3.2			3.2			3.2		
25	3.2			3.0			3.4		
26	3.0			3.0			3.1		
27	3.0			3.0				3.0	
28	3.0								

SECTION 5.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULLEE DAM - 1961

All Temperatures in °C

March						
Date	1 AM	5 AM	6 AM	9 AM	1 PM	4 PM 5 PM
1	3.0			3.1	3.1	3.0
2	3.0			3.1	3.1	3.0
3				3.0	3.0	3.0
4	3.0			3.1		3.0
5	3.0			3.1		3.1
6	3.1			3.1		3.1
7	3.1			3.2		3.2
8	3.1	3.1		3.4		3.3
9	3.2	3.2		3.3		3.3
10	3.3	3.3		3.3		3.4
11	3.3	3.3	3.4	3.4	3.4	
12	3.4	3.4		3.4	3.5	
13	3.4	3.5		3.4	3.5	
14	3.5	3.5		3.4	3.5	
15	3.5	3.5		3.5		3.5
16	3.5	3.5		3.5		3.6
17	3.5	3.5		3.5		3.6
18	3.8			3.6		
19	3.6			3.7		
20	3.7			3.7		
21	3.8			3.8		
22	3.8			3.8		
23	3.8			3.9		
24	3.9			3.9		
25	3.9			3.9		
26	4.0			4.0		
27	4.0			4.2		
28	4.1			4.1		
29	4.1			4.1		
30					4.2	
31						4.2

SECTION 5.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1961

All Temperatures in °C

April								
Date	1 AM	5 AM	8 AM	9 AM	1 PM	3 PM	4 PM	5 PM
1	4.2			4.2				4.2
2	4.3			4.3				4.4
3	4.4			4.4				4.5
4	4.4		4.4					4.9
5	4.4		4.9					5.0
6	4.8		4.9					5.0
7	4.9		4.9				4.9	
8	4.9			4.9				5.1
9	5.1			5.1				5.1
10	5.3			5.3				5.3
11	5.4			5.3	5.3			
12	5.3			5.4	5.4			5.3
13	5.5		5.5		5.5			5.5
14	5.6			5.6	5.6			5.5
15	5.7			5.8				5.6
16	5.7			5.6				5.8
17				6.0				6.0
18	6.0			6.1				6.0
19	6.2	6.2		6.3				6.1
20	6.1	6.1		6.2				6.2
21	6.4	6.4		6.4				6.8
22	6.8			6.8				6.9
23	6.9	6.9		7.0				6.9
24	6.9	6.9		7.2				7.2
25	7.4	7.4		7.2			7.0	
26	6.9	6.9		7.0			6.8	
27	6.8			6.6				6.9
28	6.9	6.9		6.7				
29	6.6			6.9				7.1
30	6.9			6.9		7.1		

SECTION 5.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1961

All Temperatures in °C

May											
Date	1 AM	7 AM	8 AM	9 AM	10 AM	3 PM	4 PM	5 PM	7 PM	10 PM	11 PM 12 PM
1	7.2			6.8			7.2				
2	7.0			7.1			7.3				
3	7.2			7.2					7.3		
4	7.2			7.3				7.3			
5	7.5			7.4				7.9			
6	7.2			7.5				7.4			
7	7.3			7.4				7.4			
8	7.4			7.5			7.6				
9	7.4			7.5			7.5				7.5
10	7.5			7.9		7.5					7.8
11	7.8			8.0		8.0					
12	7.9				8.0		8.2				7.9
13	8.1	8.4					8.4				8.1
14	8.3		8.3				8.3			8.4	8.3
15	8.4		8.7				8.5				
16	8.7			8.7			8.7				8.7
17	8.7		8.8				8.7				
18	8.7		8.9				8.9				8.9
19	8.9		9.0				9.0				9.0
20	9.0		9.1				9.2				
21	9.0		9.1				9.1				
22	9.2		9.1					9.3			
23	9.3			9.2					9.3		
24	9.3			9.4			9.4				
25	9.3		9.4			9.5					
26	9.7						10.0				
27	10.0		10.0				9.9				
28	10.0		9.9				10.0				
29	10.0		10.1				10.3				
30	10.5		10.5				10.6				
31	11.0		11.0			10.8					

SECTION 5.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1961

All Temperatures in °C

June						
Date	1 AM	5 AM	7 AM	8 AM	9 AM	3 PM 4 PM 5 PM 12 PM
1	11.1			11.1		11.0
2	11.2			11.1		11.3
3	11.2			11.2		11.2
4	11.2			11.2	11.4	
5	11.3			11.3		11.3
6	11.3			11.3		11.4
7	11.4			11.4		
8	11.5			11.5		11.5
9	11.7			11.6		11.7
10	11.8			11.8		12.0
11	12.2			12.2		12.3
12	12.4			12.5		12.6
13	12.6			12.7		12.8
14	12.8			12.7		12.6
15	12.6			12.5		12.5
16	12.5		12.5	12.6		12.5
17	12.4			12.6		12.5
18	12.5			12.4		12.5
19	12.5			12.6		12.7
20	12.7			12.7		12.8
21	12.8			12.8		
22	12.9			13.0		
23	13.0			13.1		
24	13.1			13.4		
25	13.3			13.5		
26	13.4			13.6		
27	13.5			13.9		
28	13.9			14.2		
29	13.9					
30	13.9					

SECTION 5.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1961

All Temperatures in °C

July

Date	1 AM	8 AM	9 AM	3 PM	4 PM	5 PM	10 PM	12 PM
1	14.0		14.0		14.0			14.1
2	14.1		14.4		14.2			
3	14.1	14.2			14.3			
4	14.4	14.3			14.4	14.4		
5	14.5	14.3			14.4	14.3		
6	14.4		14.3		14.3	14.3		
7	14.2		14.3		14.3	14.3		
8	14.3	14.4			14.3	14.3		
9	14.3	14.4			14.3	14.3		
10	14.3	14.5			14.4	14.4		
11	14.4	14.5			14.5	14.5		
12	14.5	14.6			14.5	14.5		14.5
13	14.5	14.6			14.5	14.5		
14	14.6	14.7			14.7	14.7		
15	14.6	14.7			14.7	14.7		
16	14.8	14.7			14.7	14.7		
17	14.6	14.8			14.6	14.6		
18	14.6	14.7			14.7	14.7		
19	14.7	14.7			14.7	14.7		
20	14.7	14.7			14.7	14.7		
21	14.7			14.7				
22	14.7							
23	14.9	14.8			14.8	14.8		
24	14.8				14.8	14.8		
25	14.7				14.7	14.7		
26	14.8				14.7	14.8		
27	14.8				14.9	14.9		
28	15.4				15.2	14.9		
29	15.3				15.0	15.0		
30	14.9				15.0	15.0		
31	15.1				15.1	15.1		15.2

SECTION 5.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1961

All Temperatures in °C

August							
Date	1 AM	8 AM	9 AM	3 PM	4 PM	5 PM	7 PM 11 PM 12 PM
1	15.2		15.6			15.3	15.2
2	15.2		15.3			15.3	
3	15.2		15.2			15.5	15.3
4	15.3		15.6			15.5	
5	15.5		15.7		15.7		
6	15.7		15.6		15.6		
7	15.6		15.7		15.8		
8	15.5		15.9		16.2		
9	16.0		16.0		16.2		
10	16.0		15.9		16.2		
11	16.1		15.9		16.9		
12	15.9		15.9		15.9	16.1	
13	16.0		16.2		16.2		
14	16.2		17.0		17.0		16.2
15	16.2	16.2		16.9			16.3
16	16.3	16.9		17.5			16.6
17	16.8		17.2				
18	16.9		16.8				
19	16.6	16.7					
20	16.8		17.0				17.0
21	17.0	16.8					17.1
22	17.1		17.9				
23	17.5	17.4					
24	17.4	17.4					
25	17.3	17.2					
26	17.6	17.4					
27	17.4	17.5					
28	17.7	17.5					
29	17.7	17.5					
30	17.5	17.6					
31	17.8		17.7		17.8	17.9	

SECTION 5.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1961

All Temperatures in °C

September							
Date	1 AM	8 AM	9 AM	2 PM	4 PM	5 PM	12 PM
1	17.8		18.0		18.2		
2	18.2		18.2		18.0		
3	18.1		18.0		17.9		
4	17.9		18.0		18.1		
5	18.3		18.2		18.2		
6	18.3		18.2		18.2		
7	18.5		18.4		18.4		
8	18.3				18.5		
9	18.5		18.1	18.1			
10	18.2		18.2		18.1		
11	18.3		18.7		18.3		18.6
12	18.6		18.6		18.5		
13	18.4		18.7		18.5		
14	18.5		18.5		18.4		
15	18.6		18.5		18.7		
16	18.7		18.6		18.5		
17	18.7	18.5			18.6		
18	18.6	18.5			18.5		
19	18.6		18.6		18.9		
20	18.9		18.7		18.7		
21	18.7		18.6		18.7		
22	18.8		18.9		18.8		
23	18.7	18.6			18.7		18.7
24	18.7	18.6			18.6		
25	18.7	18.6			18.6		
26	18.6		18.6		18.4		
27	18.6		18.5			18.5	
28	18.7		18.6			18.5	
29	18.4		18.5			18.5	
30	18.4		18.4			18.4	

SECTION 5.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1961

All Temperatures in °C

October

Date	1 AM	2 AM	8 AM	9 AM	10 AM	1 PM	4 PM	5 PM	6 PM
1	18.4		18.3	18.2				18.3	
2	18.2							18.2	
3		18.1	18.2	18.2		18.2		18.2	
4		18.0		18.0				18.0	
5		18.0		18.0				18.0	
6	17.8			17.8				17.9	
7	17.8			17.7				17.9	
8	17.8			17.8				17.8	
9	17.5		17.7					17.7	
10	17.6		17.5	17.5				17.5	
11	17.6		17.5	17.4				17.5	
12	17.5			17.4			17.4		
13	17.5			17.5			17.3		
14	17.4			17.3					
15	17.3			17.3			17.3		
16	17.1			17.0			16.9		16.6
17	17.0			16.9					
18	16.9			16.9			16.7		
19	17.0			16.9			15.4		
20	16.7			16.8			16.6		
21	16.5		16.4				16.5		
22	16.4			16.4			16.4		
23	16.4			16.3				16.3	
24	16.2			16.2				16.1	
25	16.0			16.1				16.2	
26	16.0			16.0				16.0	
27	15.8			15.9				15.8	
28	15.6			15.6				15.5	
29	15.5			15.4				15.4	
30	15.4				15.3				
31	15.2			15.2			15.1		

SECTION 5.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1961

All Temperatures in °C

November					
Date	1 AM	8 AM	9 AM	3 PM	4 PM 5 PM 6 PM
1	14.9		15.0		14.9
2	14.8		14.8		14.8
3	14.7		14.8		14.7
4	14.6		14.5	14.4	
5	14.4		14.4	14.3	
6	14.2		14.3	14.2	
7	14.2		14.2	14.0	
8	13.9		13.8	13.9	
9	13.8	13.9			13.7
10	13.7		13.6		13.7
11	13.6		13.4		13.6
12	13.4		13.3		13.3
13	13.2		13.3		13.3
14	13.1		13.1		13.4
15	13.4		13.2		13.1
16	13.0		13.1		12.9
17	12.8		13.0		12.9
18	12.8		12.6		12.5
19	12.6		12.7		12.4
20	12.5		12.4		
21	12.3		12.3		12.2
22	12.2		12.1		12.0
23	11.8		11.8		11.8
24	11.8		11.9	11.8	
25	11.5		11.5	11.5	
26	11.5		11.3	11.3	
27	11.4		11.3		
28	11.1		11.2	11.2	
29	11.1		10.9	10.9	
30	11.0		10.9		10.8

SECTION 5.8

WATER TEMPERATURES AT 1035' LEVEL
GRAND COULEE DAM - 1961

All Temperatures in °C

December						
Date	1 AM	8 AM	9 AM	10 AM	4 PM	5 PM
1	10.7		10.7			10.6
2	10.6		10.5			10.5
3	10.5		10.3		10.4	
4	10.4		10.2		10.2	
5	10.3		10.2		10.0	
6	9.9			9.8	9.7	
7	9.8		9.7		9.6	
8	9.7	9.5			9.5	
9	9.4		9.2		9.3	
10	9.2		9.2		9.3	
11	9.1		9.2		9.1	
12	9.1					
13	8.8	8.8			8.8	
14	8.8	8.5			8.5	
15	8.2	8.2			8.4	
16	8.2	8.1			8.2	
17	8.5	8.3			8.0	
18	8.0	8.0			8.0	
19	8.0	8.0			8.0	
20	7.9	8.0			8.2	
21	7.8	7.6				7.5
22	7.7	8.0				7.6
23	7.7	7.7			8.1	
24	7.8	7.5			7.6	
25	7.3		7.4			7.5
26	7.5		7.3			7.6
27	7.3		7.3			7.4
28	7.5		7.5			7.5
29	7.5	7.3				7.5
30	7.3	7.1				7.1
31	7.1		7.0			7.1

SECTION 5.9

WATER TEMPERATURES BELOW GRAND COULEE DAM

°C					
Date	August	September	October	November	December
<u>1961</u>					
1	16.1	18.0	18.3	14.9	10.7
2	15.9	18.1	18.2	14.8	10.5
3	15.9	18.0	18.2	14.8	10.4
4	16.0	18.0	18.1	14.5	10.3
5	16.1	18.2	18.0	14.4	10.2
6	16.1	18.2	17.8	14.3	9.8
7	16.0	18.4	17.8	14.2	9.7
8	16.7	18.4	17.8	13.9	9.5
9	16.6	18.2	17.6	13.8	9.3
10	16.0	18.2	17.5	13.7	9.3
11	16.2	18.4	17.5	13.5	9.1
12	17.3	18.5	17.4	13.3	9.0
13	17.6	18.6	17.5	13.2	8.8
14	17.8	18.4	17.3	13.1	8.7
15	17.1	18.6	17.3	13.3	8.3
16	17.6	18.6	17.0	13.0	8.2
17	17.6	18.6	16.8	12.9	8.3
18	17.3	18.6	16.9	12.7	8.0
19	17.3	18.7	16.7	12.6	8.0
20	17.8	18.7	16.7	12.5	8.0
21	17.4	18.7	16.5	12.3	7.7
22	17.5	18.8	16.4	12.1	7.7
23	17.4*	18.7	16.3	11.8	7.8
24	17.4	18.6	16.2	11.8	7.6
25	17.4	18.6	16.1	11.5	7.4
26	17.5	18.6	16.0	11.3	7.5
27	17.5	18.5	15.8	11.3	7.3
28	17.6	18.6	15.7	11.2	7.5
29	17.6	18.5	15.5	10.9	7.4
30	17.6	18.4	15.3	10.9	7.2
31	17.7		15.2		7.1

* After 8/23/61 no spill over top of dam. All spill through by-pass tube.

DATE

FILMED

9/12/94

END