

AGE AND GROWTH OF TUOLUMNE
RIVER BROWN TROUT

A Fisheries 195 Project

by

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submitted to

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AGE AND GROWTH OF FISHES HEATCH HETCHY RESERVOIR

INTRODUCTION

The purpose of this project was to investigate the age and growth of brown trout in the Tuolumne River below Hetch Hetchy reservoir. Fish were collected from transect areas which were established on the river. This study is based on the general acceptance of the use of salmonid scales for age and growth studies. Alvord (1953) reported that for young brown trout scale readings are dependable indicators of age, but that older fish often do not form discernible annuli.

METHODS AND PROCEDURES

Scale samples were taken from sixty brown trout collected during the summer of 1968 by the U. S. Fish & Wildlife Service and the California Department of Fish and Game. Methods of capture included the use of: chemical poisons; gillnets; spearguns; and angling gear (Table 1). Scale samples are believed to have been taken from the left and/or right sides of each fish in the area below the anterior edge of the dorsal fin but above the lateral line. The scales were placed in coin envelopes and the following data usually recorded: 1) fork length; 2) location; 3) date; 4) gear (Table 1). About two-thirds of the scales were collected in mid-September, and most of the remaining one-third in August. Two samples were collected from Transect One (T-1); thirty from T-3; nine from T-4; sixteen from T-5; two from T-4 or 5; and one from an unrecorded location.

Two methods of preparing the scales for reading were tried. Plastic impressions were tried first, but they failed to produce clear reproductions. Dry mounts were easier to prepare ^{and} from five to eight scales from each fish were mounted between glass slides.

See this method
The slides were viewed on a scale projector at a magnification of approximately 95x. Readings were taken about 30 degrees above or below the posterior radius of the scales. An initial reading was made of each of the scale samples. Then, as a second reading of each scale was taken, a comparison was made to the first reading and conflicts resolved by making adjustments in the second reading if necessary. A nomograph was constructed to find the length of the fish at each annulus.

TABLE 1. BASIC DATA FOR THOLINKE REVER BROWN TROUT SCALE SAMPLES
COLLECTED IN 1968.

No.	Age	Length	location	Date	Gear	No.	Age	Length	location	Date	Gear
1	2	11.50	T-5	9-11	chem	45	2	9.25	T-1	8-15	hnds
2	2	9.00	T-5	9-11	chem	46	2	10.00	T-3	8-14	---
3	2	12.25	T-5	9-11	chem	47	R	10.00	T-3	7-21	---
4	3(2)	11.00	T-4 or 5	8-31	---	48	2	10.00	T-3	8-02	---
5	3	11.50	T-4	9-12	gill	49	1	4.50	T-3	9-05	spgn
6	3(2)	10.25	T-4	9-12	gill	50	R	6.00	---	7-20	R&R
7	2	8.75	T-4	9-12	gill	51	2	8.00	T-3	8-17	---
8	2	8.00	T-4	9-12	gill	52	2	8.50	T-3	8-14	---
9	2(1)	6.50	T-4	9-12	gill	53	3(2)	8.50	T-3	8-14	---
10	2	7.75	T-4	9-12	gill	54	2	8.50	T-3	8-14	---
11	2	8.75	T-4	9-12	gill	55	3(2)	9.00	T-1	9-02	---
12	2	13.50	T-4	9-12	gill	56	R	9.00	T-3	7-24	R&R
13	2	10.25	T-4	9-12	spgn	57	2	9.00	T-3	7-21	---
14	1	6.50	T-5	9-11	chem	58	2	9.00	T-3	8-14	---
15	1	8.00	T-5	9-11	chem	59	3(2)	10.00	T-3	8-17	---
16	1	6.75	T-5	9-11	chem	---	---	---	---	---	---
17	3(2)	10.00	T-3	8-14	---	---	---	---	---	---	---
18	3(2)	10.00	T-3	8-14	---	---	---	---	---	---	---
19	2	9.50	T-3	7-21	---	---	---	---	---	---	---
20	2	9.25	T-3	9-05	spgn	---	---	---	---	---	---
21	2(1)	8.00	T-5	9-11	chem	---	---	---	---	---	---
22	2(1)	6.50	T-5	9-11	chem	---	---	---	---	---	---
23	2	5.75	T-5	9-11	chem	---	---	---	---	---	---
24	1	7.75	T-5	9-11	chem	---	---	---	---	---	---
25	2	7.25	T-5	9-11	chem	---	---	---	---	---	---
26	2	7.75	T-5	9-11	chem	---	---	---	---	---	---
27	2	6.50	T-5	9-11	chem	---	---	---	---	---	---
28	2	9.25	T-5	9-11	chem	---	---	---	---	---	---
29	2	10.25	T-5	9-11	chem	---	---	---	---	---	---
30	2	12.00	T-4 or 5	8-31	---	---	---	---	---	---	---
31	1	7.00	T-3	9-16	chem	---	---	---	---	---	---
32	2	9.00	T-3	9-16	chem	---	---	---	---	---	---
33	2	12.75	T-3	9-16	chem	---	---	---	---	---	---
34	2	9.75	T-3	9-16	chem	---	---	---	---	---	---
35	2(1)	7.00	T-5	9-12	spgn	---	---	---	---	---	---
36	1	5.75	T-3	9-16	chem	---	---	---	---	---	---
37	2	14.50	T-3	8-17	---	---	---	---	---	---	---
38	2	14.00	T-3	8-02	---	---	---	---	---	---	---
39	2	13.00	T-3	8-17	---	---	---	---	---	---	---
40	2	11.50	T-3	8-17	---	---	---	---	---	---	---
41	2	11.50	T-3	8-14	---	---	---	---	---	---	---
42	2	10.50	T-3	7-24	R&R	---	---	---	---	---	---
43	2	10.50	T-3	8-14	---	---	---	---	---	---	---
44	2	10.00	T-3	8-14	---	---	---	---	---	---	---
45	2	10.00	T-3	8-14	---	---	---	---	---	---	---

* age = the number of observed annuli on each scale.

** length is recorded to nearest 0.25 inches.

*** location is given to nearest transect number.

**** date is given as month-day.
***** gear is recorded as follows:
chemicals (chem), gillnet (gi),
speargun (spgn), rod-and-reel
(R&R), hands (hnds).

1/ 3(2) indicates a fish with an annulus at scale's edge. The value in parenthesis is the age if "edge-annulus" is not included.

2/ R = regenerated scales

RESULTS

Of the sixty scale samples collected, (eleven) (18.3%) contained scales that were at least partially regenerated. These scales were considered unreadable. The forty-nine scale samples which were readable showed much variation in size, shape, and annulus formation. (Eleven) of the readable scale samples (22.5%) showed a phenomenon which appeared to be an annulus forming at the edge of the scales. Some fish ~~seemed to grow~~ faster than others with considerable variation between fish from the same areas. The fish were hard to age, ~~and in general the scales showed either spurts of growth rate or slow constant growth.~~ *large variation in*

A linear relationship ($Y = a + bX$) between scale length and body length was assumed (figure 1). Calculations for the regression line yielded an "a" value of 3.48 inches, with an r^2 value of 0.4568. The "a" value indicates the time of scale formation. And since 3.48 is exceptionally large and probably not a true value for brown trout, a lesser value of 1.5 inches (38mm) was used. ~~Wootton~~ and Herrey (1961) report that "Parrot (1932) found that the average standard length of brown trout (*Salmo trutta*) at first scale formation was 35 millimeters." He also found that in Atlantic Salmon "size rather than age appears to determine time of scale formation." In a personal conversation, Dr. Van Wink indicated that 35mm was close to the size at scale formation that he found for brown trout in a Georgia stream.

40. Five of the forty-nine readable scale sample were from four year old fish. The largest of these fish was 14.50 inches while the smallest was 12.25 inches (Table 1). None of the age 4 fish exhibited the edge-annulus characteristic. The average size at each age was: 4.75 inches at the end of the first year; 7.55 inches at the end of the second year; 10.00 inches at the end of the third year; and 12.05 inches at the end of the fourth year (Table 2). The growth increments were 4.35 inches; 3.25 inches; 2.45 inches; and 2.05 inches (Table 3).

Twelve fish were aged as three year olds. But seven of these fish exhibited an edge annulus. The fish without the edge annulus were designated age 3 fish, and the fish with the edge annulus were labeled age 3 (2) (Table 1). The growth increments of the age 3 fish were: 3.65 inches the first year; 3.10 inches the second year; and 2.55 inches the third year (Table 3). At the time of capture, the fork lengths of the seven age 3 (2) fish were less than four of the five fork

body length (fork length in inches) (Y)

$$Y = 3.45 + 1.93 (X)$$

other points:

(3.25, 12.75)
(3.75, 14.00)
(3.75, 14.50)
(4.75, 13.00)
(5.00, 13.50)

Figure 1. Regression line of body-length scale-length relationship.

scale length (inches) (X)

Table 2. AVERAGE LENGTH OF FISH AT EACH AGE WHEN AGE 3 (2) AND AGE 2 (1) FISH PUT IN THE AGE 2 AND AGE 1 YEARCLASSES.

year class	n	Age			
		I	II	III	IV
1953	5	4.35	7.55	10.00	12.05
1954	5	3.85	6.95	9.50	--
1965	28	4.28	7.40	--	--
1966	11	3.77	--	--	--
Grand average		4.13	7.36	9.75	12.05

Table 3. GROWTH INCREMENTS OF FISH AT EACH AGE WHEN AGE 3 (2) AND AGE 2 (1) FISH ARE PUT IN THE AGE 2 AND AGE 1 YEAR CLASSES.

year class	n	Age			
		I	II	III	IV
1963	5	4.35	3.25	2.45	2.05
1964	5	3.85	3.10	2.55	--
1965	28	4.28	3.12	--	--
1966	11	3.77	--	--	--
Grand average		4.13	3.05	2.50	2.05

lengths of the age 3 fish (Figure 2). The list of the age 3 fish at the formation of their third annulus varied from 7.75 inches to 11.25 inches, with the lengths of the age 3 (2) at time of formation of their third annulus between these extremes (Figure 3).

Twenty-five fish were aged as two year olds. Four of these fish had an edge annulus and were labeled 2 (1) fish. The other twenty-one fish were designated age 2 and (when the 3 (2) fish were included) the average growth increments were 4.28 inches and 3.12 inches. The age 2 (1) fish had smaller fork lengths at the time of their capture than did most of the age 2 fish (Figure 4).

Seven fish were aged as one year olds. Their average length at first annulus formation when combined with the age 2 (1) fish was 3.77 inches.

To investigate the edge annulus phenomenon, two length-frequency graphs were constructed. One graph (Figure 5) showed that the fork lengths of age 3 (2) and age 2 fish at the time of their capture were similar. And the second graph (Figure 6) showed that the fork lengths of age 2 (1) and age 1 fish were also very similar.

CONCLUSIONS

Perhaps the most significant result of this study is the revelation that the edge annulus on scales collected in August and September. The fork lengths of age 3 (2) fish and age 2 fish at the time of capture are similar. And the length at formation of the third annulus of age 3 (2) and age 3 fish are also similar (Figure 3). Likewise, the fork lengths of age 2 (1) fish (all of which are from Transects Four and Five) and of age 1 fish are very similar (Figure 6). The lengths of the age 2 fish at the time of formation of their second annulus exceeds the corresponding lengths of age 2 (1) fish (Figure 7). But the method used to mark the edge annulus was to mark it at its beginning near the edge of the scales rather than at the very edge of the scales. And if one considers the additional small amount growth to the outer edge of the scales of the 2 (1) fish, then this places them more nearly in the midst of the lengths of the age 2 fish when they formed their second annulus (Figure 8). Therefore, it is the author's opinion that the 2 (1) and the 3 (2) fish were probably forming an annulus when captured. However if this is the case, one must account for rapid growth of young fish which probably emerge in ^{late winter or early spring} and form their first annulus during the following summer.

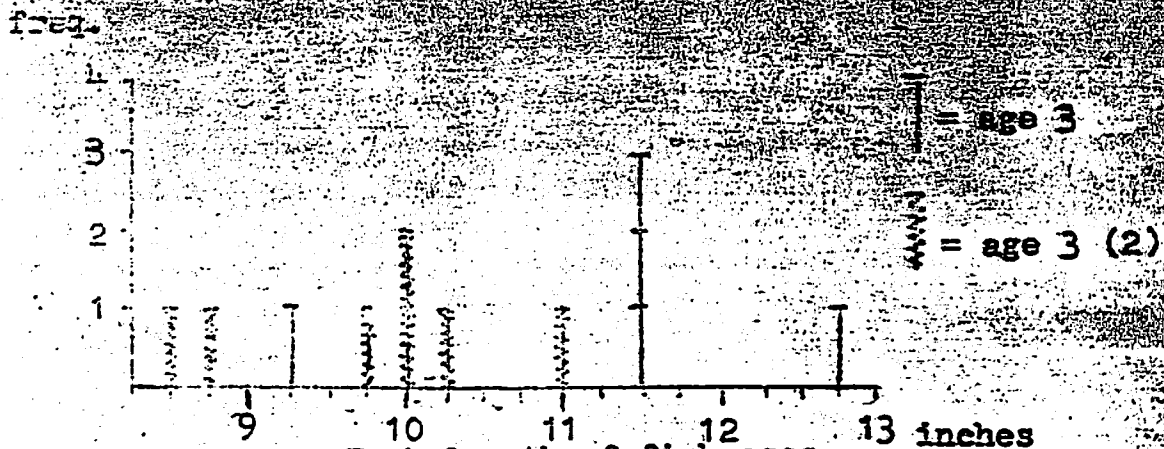


Figure 2. Fork length of fish ages 3 and 3 (2) at time of capture.

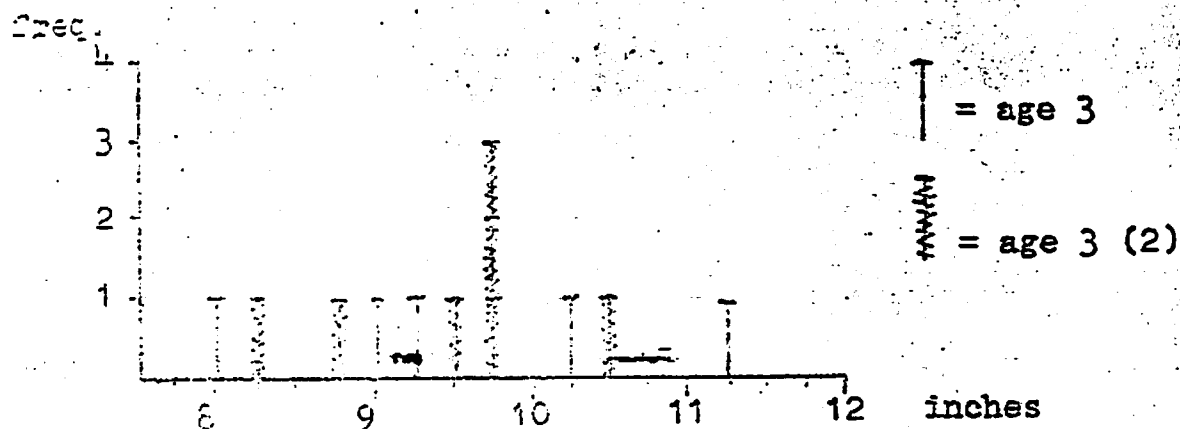


Figure 3. Length at formation of third annulus of fish ages 3 and 3 (2).

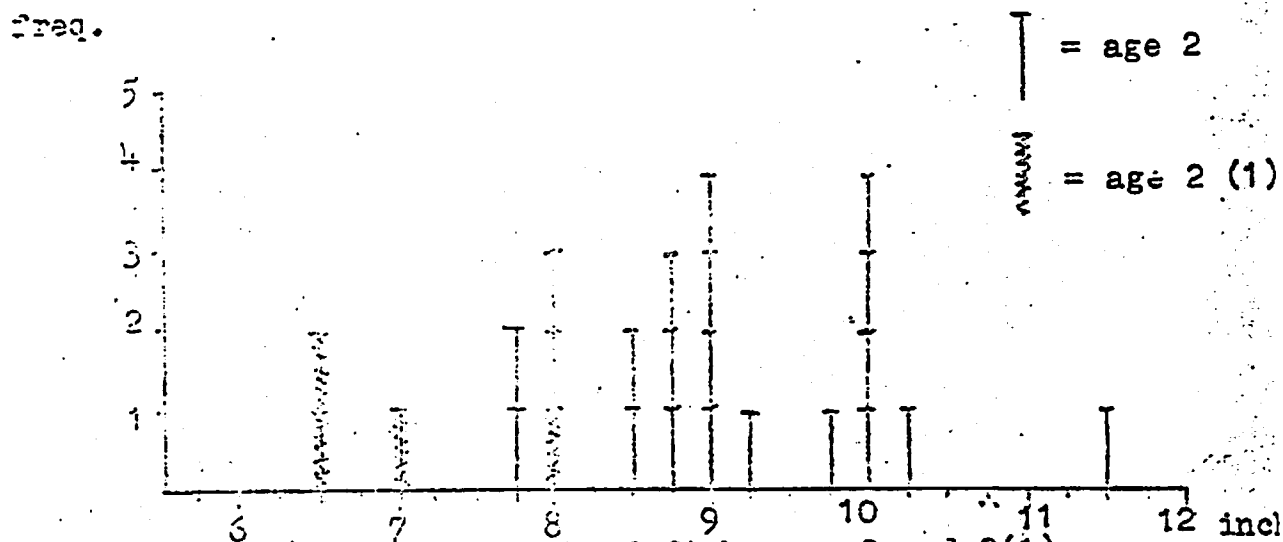


Figure 4. Fork length of fish ages 2 and 2(1) at time of capture.

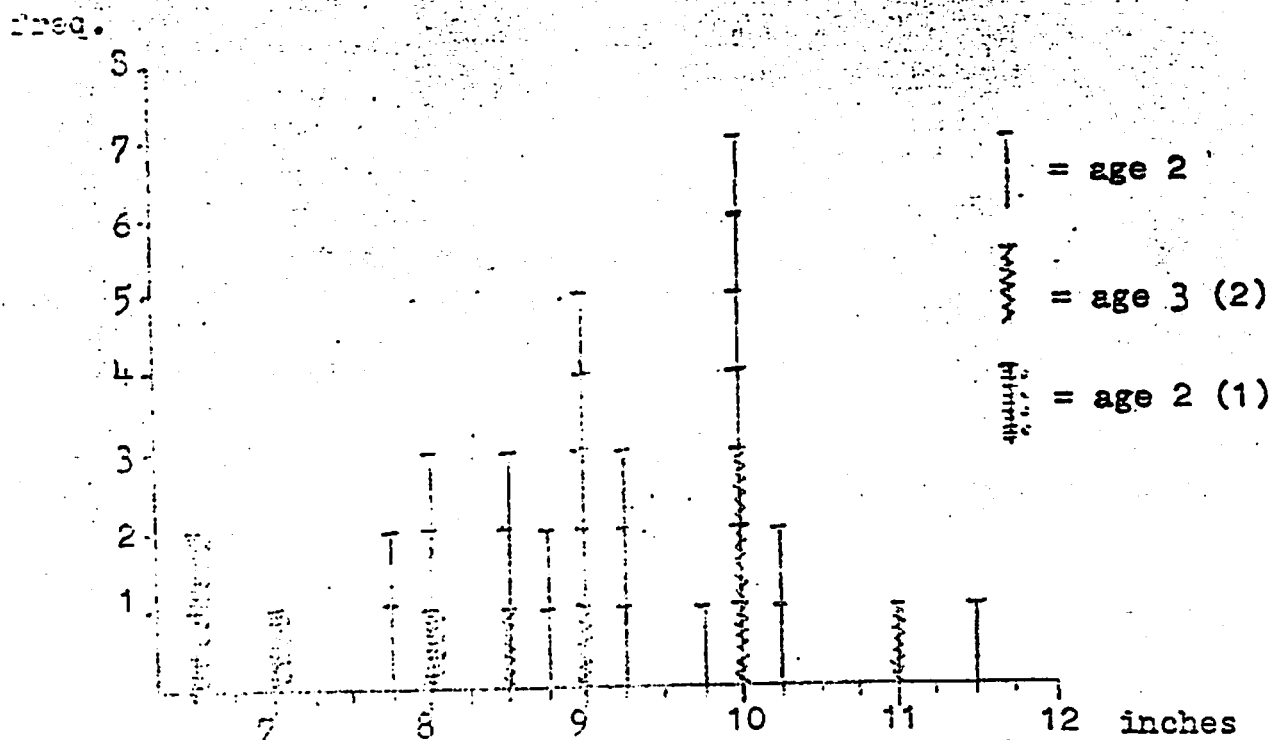


Figure 5. Length of age 3-(2), 2, and 2 (1) fish at time of capture.

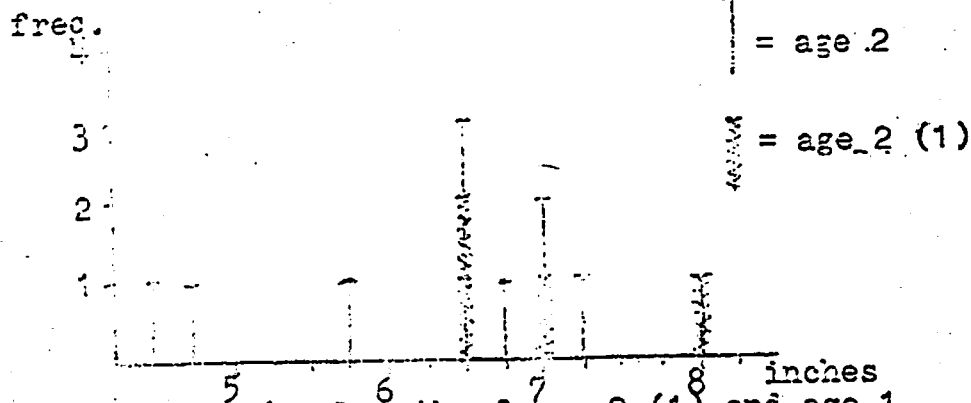


Figure 6. Length of age 2 (1) and age 1 fish at time of capture.

Figure 8. Length of age 2 fish at formation of second annulus and fork length of age 2 (1) fish.

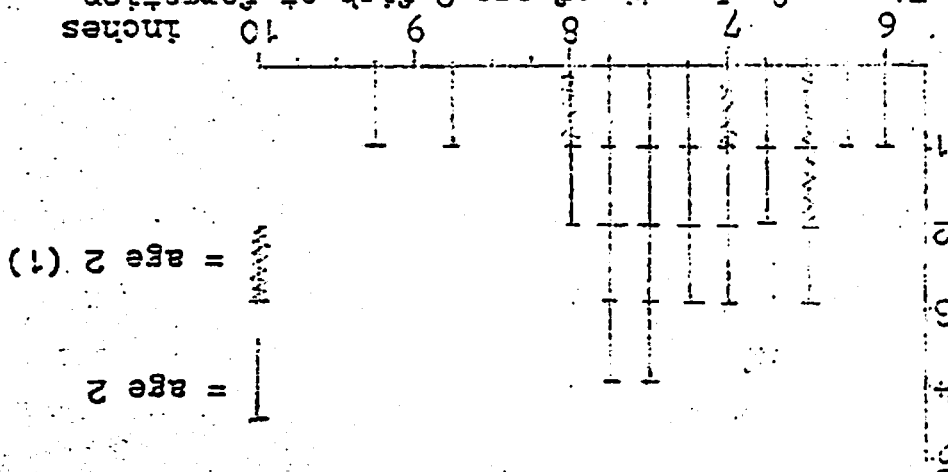
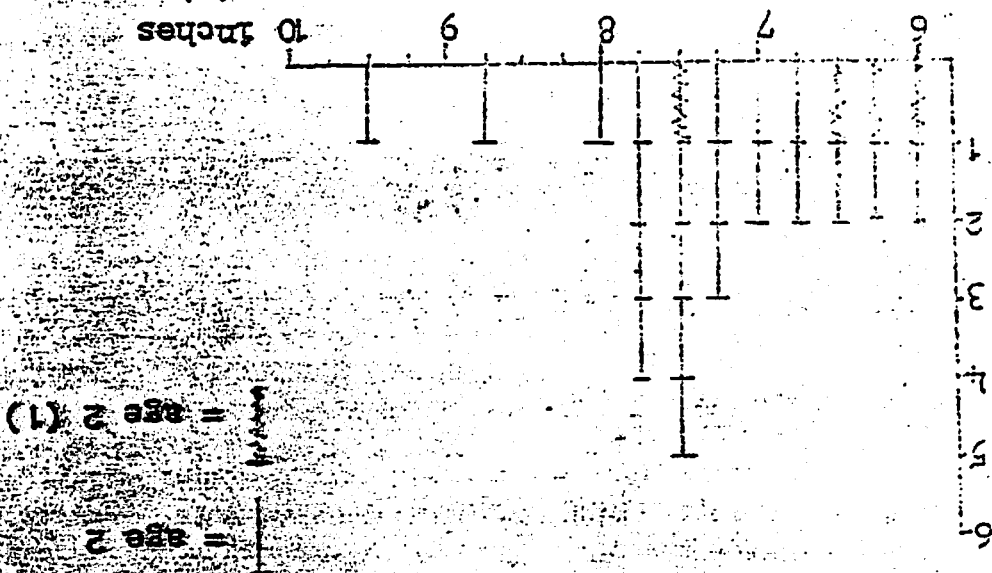


Figure 7. Length of age 2 and age 2 (1) fish at the time of formation of second annulus.



C

The growth rates for Tuolumne River brown trout are similar to the growth rates reported for brown trout in other rivers (Table 4). There seems to be good growth during the first year for the Tuolumne River fish. However, this condition of rapid growth did not extend beyond the first year.

Error from several sources probably affected the results of this study. Some of the fish collected may have been measured only to the nearest one-half inch. The area from which scale readings were taken was probably not uniform enough. These two factors could account for the large amount of the variation in the points on the body-length scale-length graph (Figure 1). Inconsistency in the site of scale removal from the fish could have been another source of error. For Alvord (1953) reported a great variation in salmonid scale size, even within a limited area.

Even considering these sources of error and the poor r^2 regression value (55% of the variation associated with the regression line was unaccounted for), the results of this project at least give a general indication of growth rates for brown trout in the Tuolumne River. However, further investigations (such as following annulus formation during a full year, and finding the true average size at scale formation) would be useful for testing the validity of this study.

ACKNOWLEDGEMENTS

I would like to thank Dr. Richard Ridenhour for his guidance and assistance during this study, and Dr. Robert Van Kirk for his assistance and suggestions, and Mr. Bill Hoeft and the U. S. Fish & Wildlife Service for providing the scales which made this project possible.

TABLE 4. SIZE OF BROWN TROUT AT ANNULUS FORMATION (I-IV)
IN SELECTED RIVERS.

River	Length (inches) At Annulus			
	II	II	III	IV
Jones Creek, Georgia* Van Kirk (1969)	3.94	7.30	9.68	12.48
L Logan River, Utah* Sigler (1952)	4.0	6.9	9.7	12.1
Missouri River, Montana* Kathrein (1950)	3.9	8.1	12.0	15.3
Tuolumne River, Calif.**	4.13	7.36	9.75	12.05
West Gallatin River,* Montana, Purkett (1951)	3.7	8.8	13.2	15.9

* Data in total length

** Data in fork length

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Only
Scale
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X

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X	Y	XY	X^2	Y^2
1.50	43.125	64.6875	2.25	1875.0625
1.00	29.250	29.2500	1.00	855.0625
1.00	49.000	49.0000	1.00	2401.0625
1.00	30.250	30.2500	1.00	915.0625
1.00	57.500	57.5000	1.00	3306.2500
1.00	40.250	40.2500	1.00	1620.0625
1.00	30.625	30.6250	1.00	937.8906
1.00	25.000	25.0000	1.00	625.0000
1.00	17.875	17.8750	1.00	319.4141
1.00	21.313	21.3125	1.00	454.2539
1.00	30.625	30.6250	1.00	937.8906
1.00	57.500	57.5000	1.00	3306.2500
1.00	40.250	40.2500	1.00	1620.0625
1.00	16.250	16.2500	1.00	264.0625
1.00	15.168	15.1680	1.00	230.0633
1.00	30.000	30.0000	1.00	900.0000
1.00	27.500	27.5000	1.00	756.2500
1.00	34.688	34.6880	1.00	1203.1654
1.00	20.000	20.0000	1.00	400.0000
1.00	13.000	13.0000	1.00	169.0000
1.00	12.688	12.6880	1.00	160.9221
1.00	24.313	24.3125	1.00	591.1953
1.00	15.750	15.7500	1.00	248.0625
1.00	18.500	18.5000	1.00	342.2500
1.00	31.688	31.6880	1.00	1004.0633
1.00	31.250	31.2500	1.00	976.5625
1.00	15.813	15.8125	1.00	250.1063
1.00	52.500	52.5000	1.00	2756.2500
1.00	48.750	48.7500	1.00	2376.5625
1.00	45.125	45.1250	1.00	2036.2500
1.00	35.000	35.0000	1.00	1225.0000
1.00	25.000	25.0000	1.00	625.0000
1.00	23.125	23.1250	1.00	534.8906
1.00	20.000	20.0000	1.00	400.0000
1.00	30.000	30.0000	1.00	900.0000
1.00	50.250	50.2500	1.00	2525.0625
1.00	20.000	20.0000	1.00	400.0000
1.00	19.125	19.1250	1.00	365.8906
1.00	25.500	25.5000	1.00	650.2500
1.00	27.000	27.0000	1.00	729.0000
1.00	24.750	24.7500	1.00	612.5625
1.00	30.000	30.0000	1.00	900.0000
1.00	43.750	43.7500	1.00	1914.0625
1.00	29.250	29.2500	1.00	855.0625
1.00	49.000	49.0000	1.00	2401.0625
1.00	30.250	30.2500	1.00	915.0625
1.00	57.500	57.5000	1.00	3306.2500
1.00	40.250	40.2500	1.00	1620.0625
1.00	30.625	30.6250	1.00	937.8906
1.00	25.000	25.0000	1.00	625.0000
1.00	17.875	17.8750	1.00	319.4141
1.00	21.313	21.3125	1.00	454.2539
1.00	30.625	30.6250	1.00	937.8906
1.00	57.500	57.5000	1.00	3306.2500
1.00	40.250	40.2500	1.00	1620.0625
1.00	16.250	16.2500	1.00	264.0625
1.00	15.168	15.1680	1.00	230.0633
1.00	30.000	30.0000	1.00	900.0000
1.00	27.500	27.5000	1.00	756.2500
1.00	34.688	34.6880	1.00	1203.1654
1.00	20.000	20.0000	1.00	400.0000
1.00	13.000	13.0000	1.00	169.0000
1.00	12.688	12.6880	1.00	160.9221
1.00	24.313	24.3125	1.00	591.1953
1.00	15.750	15.7500	1.00	248.0625
1.00	18.500	18.5000	1.00	342.2500
1.00	31.688	31.6880	1.00	1004.0633
1.00	31.250	31.2500	1.00	

CALCULATIONS FOR REGRESSION VALUES

$$\begin{aligned}\sum x^2 &= 479.888 - (148.5)^2 / 49 \\ &= 479.888 - 22,052.5 / 49 \\ &= 479.888 - 450.045 \\ &= 29.84\end{aligned}$$

$$\begin{aligned}\sum y^2 &= 4,472.321 - (455.25)^2 / 49 \\ &= 4,472.321 - 207,252.563 / 49 \\ &= 4,472.321 - 4,229.644 \\ &= 242.67\end{aligned}$$

$$\begin{aligned}\sum xy &= 1,437.185 - (455.25)(148.5) / 49 \\ &= 1,437.185 - 67,604.63 / 49 \\ &= 57.503\end{aligned}$$

$$b = 57.50 / 29.84 = 1.928$$

$$\begin{aligned}\bar{x} \\ \bar{X} &= 148.5 / 49 = 3.03\end{aligned}$$

$$\bar{Y} = 455.25 / 49 = 9.29$$

$$a = 9.29 - (1.928)(3.03) = 3.448$$

$$\begin{aligned}r^2 &= (57.503)^2 / (29.84)(242.67) \\ &= 3,306.3995 / 7,238.846 = 0.4568 \\ &= 45.68\%\end{aligned}$$

$$r = \sqrt{0.4568} = 0.676$$

RIVER BROWN TROUT

NO.	Age	Length	at first capture	Age 1	Age 2	Age 3	Age 4
1	3		11.50	3.75	6.50	9.25	
2	2		9.00	4.00	6.75		
3	4		12.25	4.50	8.50	10.00	11.75
4	3(2)		11.00	4.50	8.50	10.50	
5	3		11.50	4.25	7.75	10.25	
6	3(2)		10.25	4.25	6.75	9.75	
7	2		8.75	3.75	7.25		
8	2		8.00	4.25	7.00		
9	2(1)		6.50	3.25	6.25		
10	2		7.75	3.50	6.25		
11	2		8.75	3.75	6.50		
12	4		13.50	4.00	7.25	9.75	12.25
13	2		10.25	5.25	9.50		
14	1		6.50	4.00			
16	1		6.75	4.25			
17	3(2)		10.00	4.00	7.25	9.75	
18	3(2)		10.00	4.25	7.50	9.50	
20	3		9.25	3.25	5.00	7.75	
21	2(1)		8.00	4.25	7.50		
22	2(1)		6.50	3.25	6.00		
24	1		4.75	3.75			
25	1		7.25	5.25			
26	2		7.75	3.50	6.00		
28	2		9.25	4.50	7.50		
31	1		7.00	4.50			
32	2		9.00	4.50	7.75		
33a	3		12.75	5.00	8.75	11.25	
33b	2		9.75	4.25	7.50		
34	2(1)		7.00	4.00	6.50		
35	1		5.75	3.50			
36	4		14.50	3.75	7.50	9.75	11.25
37	4		14.00	4.75	8.25	11.25	13.00
38	4		13.00	4.75	7.25	9.25	11.50
39	2		11.50	5.50	8.75		
40	3		11.50	4.75	6.75	9.00	
43	2		10.00	3.50	8.00		
44	2		10.00	5.00	7.75		
44	2		9.25	4.50	6.75		
45	2		10.00	4.50	7.75		
46	2		10.00	4.25	7.25		
48	2		4.50	3.50			
49	1		8.00	4.75	7.00		
51	2		8.50	4.00	7.50		
52	2		8.50	3.75	7.00	8.25	
53	3(2)		8.50	4.50	7.50		
54	2		8.50	4.00	7.00	8.75	
55	3(2)		9.00	4.00	7.75		
57	2		9.00	3.75	7.25		
58	2		9.00	4.00	8.00	9.75	
59	3(2)		10.00				

Files

February 11, 1969

Wildlife Biologist, RBS, Sacramento

the City's release of up to 750 c.f.s. in the river August 11, 1968
 Aquatic Bottom Sampling, Tuolumne River Fish Study, 1968 - Kirkwood
 Power project (Hetch-Hetchy Division) - City and County of San Francisco.

The following are the ^{partial} results of the aquatic bottom sampling conducted during the 35 c.f.s. flow, September 8-10, 1968, of subject study.

Using the Surber sampler, twelve 1-square foot sample area sections were taken on each of the three transect stations in the Yosemite National Park reach. The contents of each transect site sample were bottled and taken to the Hetch-Hetchy crew cabins where analyses of the organisms were completed. Organisms were keyed to Order only.

<u>Transect Station</u>	<u>Order</u>	<u>No. of Organisms</u>	<u>Weight Volume Displacement</u>
T-1/T-2	Diptera	25	---
	Tricoptera	5	---
	Plecoptera	19	---
	Ephemeroptera	<u>12</u>	---
		61	0.11 cc
T-3	Diptera	28	---
	Tricoptera	6	---
	Plecoptera	42	---
	Ephemeroptera	<u>24</u>	---
		100	0.45 cc <

Total organisms and weight of 36 1-sq. ft. Surber samples of three transect stations:

<u>Organisms</u>	<u>Number - Organisms</u>	<u>Weight</u>
Diptera	53	---
Tricoptera	11	---
Plecoptera	61	---
Ephemeroptera	<u>36</u>	---
Total	161	0.56 cc

Based on the standards of richness food grades in Lagler's Freshwater Fishery Biology, pg. 305, this sample could be classified as Food Grade 3 (poor).

Possibly one reason why the sample is relatively poor is because of the City's release of up to 731 c.f.s. in the river August 10-11, 1968 prior to the start of the flow study. Needless to say, this high flow scoured the river bottom of accumulative organisms present since the winter-spring season.

The second year of study should include representative bottom sampling at each transect site. No high flow releases by the City should be allowed prior to completion of the flow study during this time.

Upon accumulation of all bottom sampling data, the sample totals should be expanded to apply to the entire 12-mile study reach to obtain an overall food grade value.

Donald A. Duff

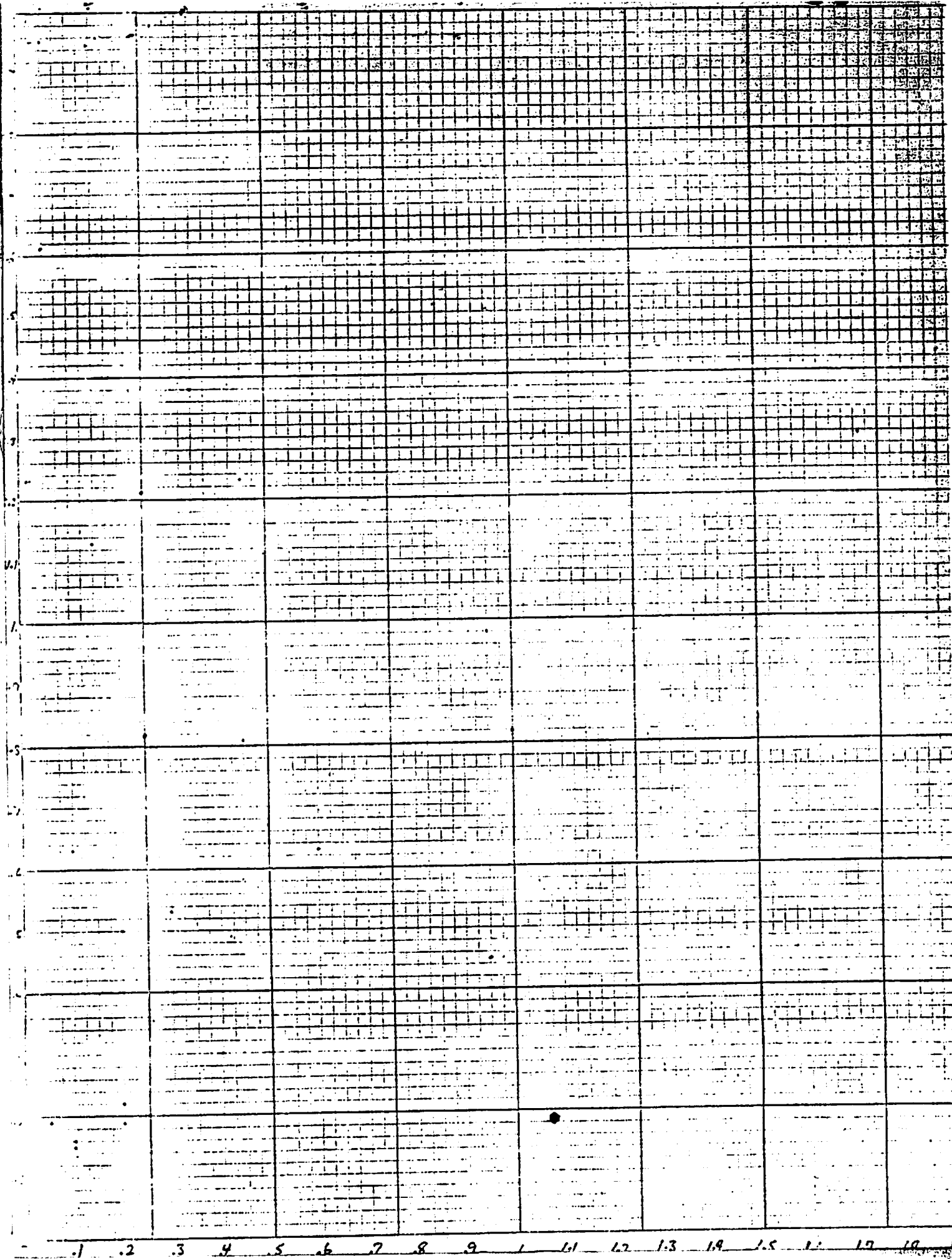
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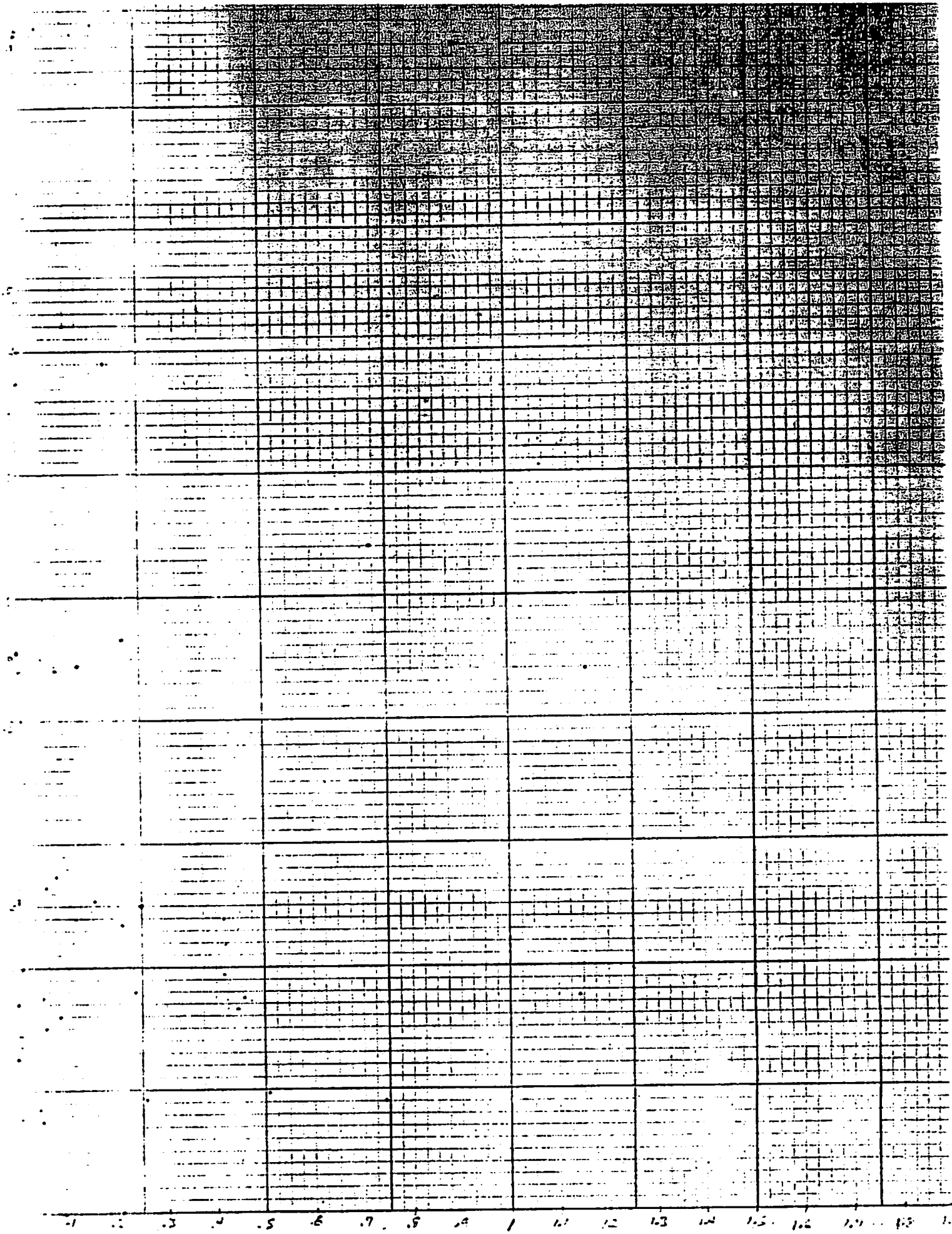
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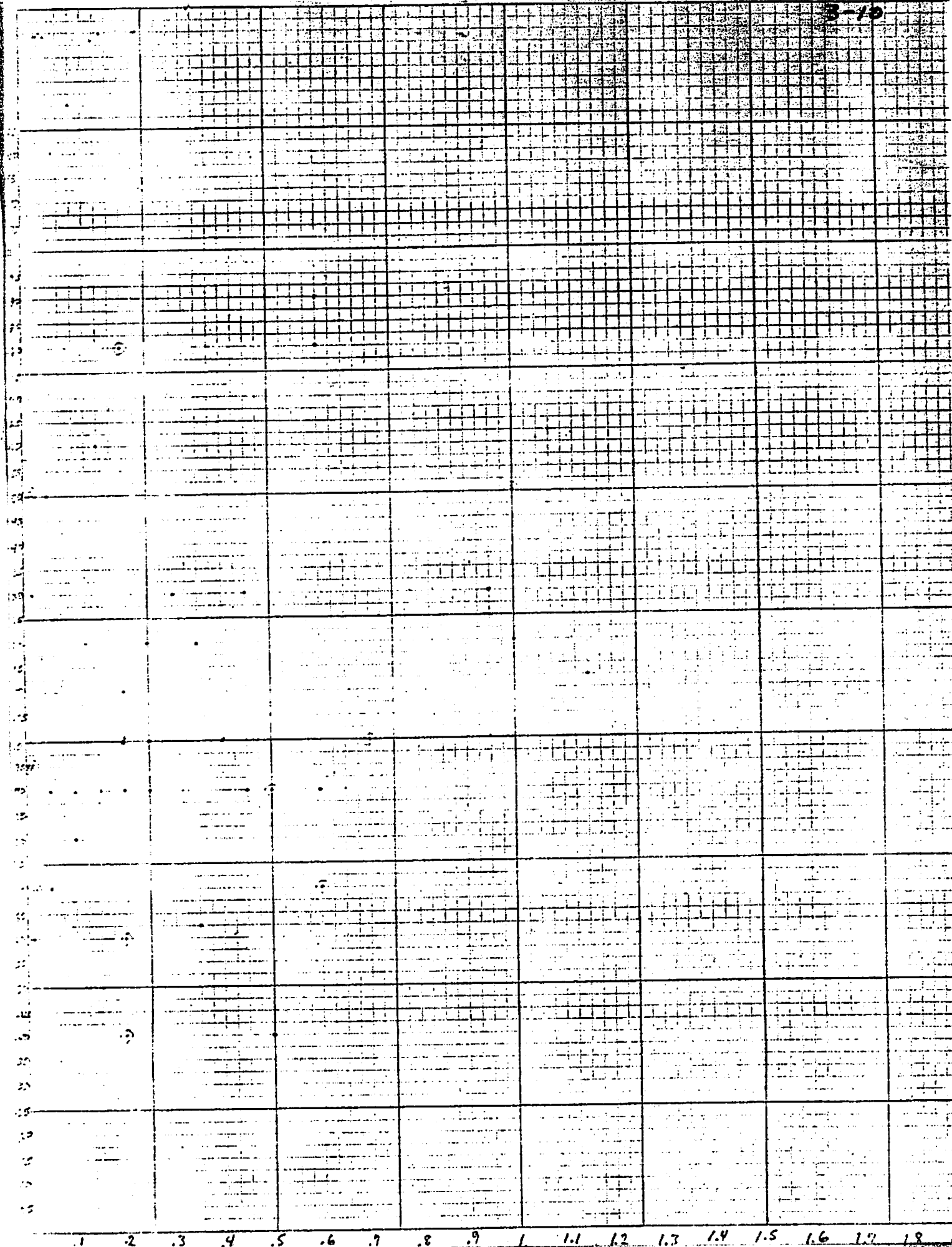
Sample No.		Location		Stream		Time		Notes	
3/24/59	A	T-L	VA	1.5	1.5	1.5	1.5	1.5	1.5
"	B	"	"	1.5	1.5	1.5	1.5	1.5	1.5
"	C	"	"	1.5	1.5	1.5	1.5	1.5	1.5
"	D	"	"	1.5	1.5	1.5	1.5	1.5	1.5
"	E	"	"	1.5	1.5	1.5	1.5	1.5	1.5
"	F	"	"	1.5	1.5	1.5	1.5	1.5	1.5
3/20/59	A	Above H-H	No F. Decided	1.5	1.5	1.5	1.5	1.5	1.5
"	B	"	"	1.5	1.5	1.5	1.5	1.5	1.5
"	C	"	"	1.5	1.5	1.5	1.5	1.5	1.5
"	E	"	"	1.5	1.5	1.5	1.5	1.5	1.5

Date	Sample No.	Location	Stream Flow	Temp	Surf. Temp	Depth	Notes	Result
2/22/69	A	T-1	75	59	8	.91	Rock to 1"	✓
"	B	"	71	11	1	.53	Rock to 1"	✓
"	C	"	71	11	1	.35	Rock to 1"	✓
"	D	"	"	11	.9	.35	Rock to 1"	✓
"	E	"	"	11	.6	.93	Rock to 1"	✓
"	F	"	71	11	1.1	.39	Rock to 1"	✓
2/22/69	A	T-2	75	54	.9	.26	Rock to 1"	✓
"	B	"	71	11	1.4	.51	Rock to 1"	✓
"	C	"	71	11	2.1	.80	Rock to 1"	✓
"	D	"	"	11	1	.32	Rock to 1"	✓
"	E	"	71	11	1.9	.29	Rock to 1"	✓
"	F	"	"	11	.9	.21	Rock to 1"	✓
10/6/69	2	T-2	35	NR	11.1	1.35	Rock to 1"	✓
"	3	"	"	"	.8	1.44	Rock to 1"	✓
"	4	"	"	"	1.3	1.92	Rock to 1"	✓
"	5	"	"	"	1.7	1.38	Rock to 1"	✓
2/20/69	A	T-3	75	56	.7	.51	Rock to 1"	✓
"	B	"	"	11	1.2	.51	Rock to 1"	✓
"	C	"	"	11	1	.89	Rock to 1"	✓
"	D	"	"	11	1.6	.55	Rock to 1"	✓
"	E	"	"	11	1.2	.19	Rock to 1"	✓
2/26/69	A	T-4	75	64	1.1	.15	Rock to 1"	✓
"	B	"	"	11	1.8	.35	Rock to 1"	✓
"	C	"	"	11	1	.93	Rock to 1"	✓
"	D	"	"	11	1	.5	Rock to 1"	✓
"	E	"	"	11	2.2	.48	Rock to 1"	✓
"	F	"	"	11	.9	1.08	Rock to 1"	✓
2/26/69	A	T-5	75	66	.5	.48	Rock to 1"	✓
"	B	"	"	11	1.6	.34	Rock to 1"	✓
"	C	"	"	11	1.1	.27	Rock to 1"	✓
"	D	"	"	11	3	.14	Rock to 1"	✓
"	E	"	"	11	1	.19	Rock to 1"	✓
"	F	"	"	11	.7	.88	Rock to 1"	✓

Sample No	Location	Stream Flow (cfs)	Depth ft. by	Bottom Velocity ft/sec	Bottom	Volume cu ft	Notes
4/2/69	A	T-1	Appr 80 cfs	✓.9	✓.82	Rock 6" to 1'	✓.1
	B	"	"	✓1.3	✓.53	Rock 6" to 1'	✓.3
	C	"	"	✓1.0	✓1.21	Rock 6" to 1'	✓.25
	D	"	"	✓1.0	✓.97	Rock 6" to 1'	✓.95
	E	"	"	✓1.2	✓.15	1/2 Sa + 1/2 Gr	✓.1
	F	"	"	✓1.0	✓.19	Gr. with some Sa.	✓.2
4/2/69	A	T-2	35	✓.9	✓1.23	Rock 6" to 1'	✓.45
	B	"	"	✓.9	✓1.92	Rock 6" to 1'	✓.6
	C	"	"	✓1.1	✓2.54	Rock 6" to 1'	✓.2
	D	"	"	✓1.1	✓2.46	Rock 6" to 1'	✓1.15
	E	"	"	1.0	✓.30	Rock 6" to 1'	✓.4
	F	"	"	.4	✓.67	Small stones?	✓.5
4/2/69	A	T-3	35	✓1.3	✓1.23	Sa + Gr up to 1 1/2" Some detritus	✓.02
"	B	"	"	✓.7	✓1.61	Sa + Gr to 1 1/2"	✓.05
"	C	"	"	.6	✓1.38	Sa + Gr up to 1"	✓.35
"	D	"	"	.8	✓.16	Silt Sand and Detritus	✓.1
"	E	"	"	✓1.6	✓2.09	Rock and Gr to 4"	✓.15
4/3/69	A	T-4	Est 95-100	1.5	✓1.32	Rock 2" to 1' on Sa	-.05
"	B	"	"	✓.9	✓.19	Flat Rocks to 1' on Sa	✓.05
"	C	"	"	.9	✓1.13	Flat Rocks 3" to 1 1/2"	-.15
"	D	"	"	1.2	✓3.55	Rock 10" to 15"	✓.35
"	E	"	"	✓1.9	2.03	Rock 2" to 6"	-.6
"	F	"	"	✓1.2	✓.20	Rock 1" to 8" on Sa	✓.25
4/3/69	A	T-5	Est 95-100	1.3	✓.45	Rocks to 1'	✓.95
"	B	"	"	✓1.	✓1.75	Rocks to 1'	✓2.5
"	C	"	"	✓1.3	✓.81	Rocks to 8" on Sa	✓.45
"	D	"	"	✓2.3	✓.63	Sa + few Rocks	✓.1
"	E	"	"	1.5	✓1.11	Large Patch to 16"	✓1.
"	F	"	"	✓.9	✓.82	Rocks to 6" on Sa	✓.25
4/3/69	A	T-6	Est 75-100	1.	.22	Rock 10" and up	✓.2
"	B	"	"	.9	.50	Rocks 10" and up	✓.2
"	C	"	"	1.8	.63	Rocks 10" and up	.6
	F	"	"	"	.7	.88 8" on Rock	1.16







[illegible]

Stomach contents Tolune River Study - 1970

Date	Sample	Location	Stream km (KLS)	Spec	Volume (ml)	Length (cm)	Method of Capture	Remarks
5-3-70	II-32				2.5			only terrestrials noted, mainly of the Hymenoptera type.
5-3-70	II-31				1.5			a few terrestrials and a few Hymenoptera - mostly debris
5-2-70	II-29				1.5			mostly "debris", a couple of beetles.
5-2-70	II-30				1.7			beetles, bees, flies, caterpillars, and some "debris"
5-2-70	II-28				0.6			Mostly unidentified fragments, some Trichoptera larval exoskeletons
5-2-70	II-33				1.5			terrestrials - Coleoptera & Hymenoptera
5-2-70	II-49				4.4			terrestrials - "mostly Hymenoptera" and some unidentified debris
5-2-70	II-47				1.6			Stomach very "full" - 12 of some type of Hymenoptera = 2.5ml, + other Hymenoptera, Coleoptera, and at least 3 worms. Much debris near back of stomach unidentified.
5-2-70	II-46				1.3			mostly terrestrials but none of the above type of Hymenoptera found

Stomach samples Tulame River Study - 1970

Stomach Sample	Volume (ml)	Flow (ml)	Species	Remarks
I-1 SNF	1.9	262	Anyling	
I-2 SNF	1.8	200	RT	
I-3 SNF	.7	200	RT	
I-4 SNF	2.7	200	RT	
I-5 SNF	1.2	200	RT	
I-6 SNF	.3	157	RT	
I-7 SNF	.7	198	RT	
I-8 SNF	1.9	200	RT	
I-9 SNF	1.5	199	RT	
II-48 SNF	8.0	274	BT	Stomach releted because of large volume Almost entirely Hymenoptera in good condition
II-1 YNP	290	173	BT	
II-2 YNP	.3	173	RT	
II-3 YNP	200	168	RT	
II-4 YNP	.2	168	RT	
II-5 YNP	1.2	200	BT	
II-6 YNP	1.8	199	RT	
II-7 YNP	1.8	199	RT	
II-8 YNP	1.8	199	RT	
II-9 YNP	1.8	199	RT	
II-10 YNP	1.8	199	RT	
II-11 YNP	1.8	199	RT	
II-12 YNP	1.8	199	RT	
II-13 YNP	1.8	199	RT	
II-14 YNP	1.8	199	RT	
II-15 YNP	1.8	199	RT	
II-16 YNP	1.8	199	RT	
II-17 YNP	1.8	199	RT	
II-18 YNP	1.8	199	RT	
II-19 YNP	1.8	199	RT	
II-20 YNP	1.8	199	RT	
II-21 YNP	1.8	199	RT	
II-22 YNP	1.8	199	RT	
II-23 YNP	1.8	199	RT	
II-24 YNP	1.8	199	RT	
II-25 YNP	1.8	199	RT	
II-26 YNP	1.8	199	RT	
II-27 YNP	1.8	199	RT	
II-28 YNP	1.8	199	RT	
II-29 YNP	1.8	199	RT	
II-30 YNP	1.8	199	RT	
II-31 YNP	1.8	199	RT	
II-32 YNP	1.8	199	RT	
II-33 YNP	1.8	199	RT	
II-34 YNP	1.8	199	RT	
II-35 YNP	1.8	199	RT	
II-36 YNP	1.8	199	RT	
II-37 YNP	1.8	199	RT	
II-38 YNP	1.8	199	RT	
II-39 YNP	1.8	199	RT	
II-40 YNP	1.8	199	RT	
II-41 YNP	1.8	199	RT	
II-42 YNP	1.8	199	RT	
II-43 YNP	1.8	199	RT	
II-44 YNP	1.8	199	RT	
II-45 YNP	1.8	199	RT	
II-46 YNP	1.8	199	RT	
II-47 YNP	1.8	199	RT	
II-48 YNP	1.8	199	RT	
II-49 YNP	1.8	199	RT	
II-50 YNP	1.8	199	RT	
II-51 YNP	1.8	199	RT	
II-52 YNP	1.8	199	RT	
II-53 YNP	1.8	199	RT	
II-54 YNP	1.8	199	RT	
II-55 YNP	1.8	199	RT	
II-56 YNP	1.8	199	RT	
II-57 YNP	1.8	199	RT	
II-58 YNP	1.8	199	RT	
II-59 YNP	1.8	199	RT	
II-60 YNP	1.8	199	RT	
II-61 YNP	1.8	199	RT	
II-62 YNP	1.8	199	RT	
II-63 YNP	1.8	199	RT	
II-64 YNP	1.8	199	RT	
II-65 YNP	1.8	199	RT	
II-66 YNP	1.8	199	RT	
II-67 YNP	1.8	199	RT	
II-68 YNP	1.8	199	RT	
II-69 YNP	1.8	199	RT	
II-70 YNP	1.8	199	RT	
II-71 YNP	1.8	199	RT	
II-72 YNP	1.8	199	RT	
II-73 YNP	1.8	199	RT	
II-74 YNP	1.8	199	RT	
II-75 YNP	1.8	199	RT	
II-76 YNP	1.8	199	RT	
II-77 YNP	1.8	199	RT	
II-78 YNP	1.8	199	RT	
II-79 YNP	1.8	199	RT	
II-80 YNP	1.8	199	RT	
II-81 YNP	1.8	199	RT	
II-82 YNP	1.8	199	RT	
II-83 YNP	1.8	199	RT	
II-84 YNP	1.8	199	RT	
II-85 YNP	1.8	199	RT	
II-86 YNP	1.8	199	RT	
II-87 YNP	1.8	199	RT	
II-88 YNP	1.8	199	RT	
II-89 YNP	1.8	199	RT	
II-90 YNP	1.8	199	RT	
II-91 YNP	1.8	199	RT	
II-92 YNP	1.8	199	RT	
II-93 YNP	1.8	199	RT	
II-94 YNP	1.8	199	RT	
II-95 YNP	1.8	199	RT	
II-96 YNP	1.8	199	RT	
II-97 YNP	1.8	199	RT	
II-98 YNP	1.8	199	RT	
II-99 YNP	1.8	199	RT	
II-100 YNP	1.8	199	RT	

Stomach Samples
Tuslamre River Study-1970

Date	Sample	Location	Stream Elevation (ft)	Species	Volume (ml)	Length (mm)	Method of Capture	Remarks
5-13-70	III-6				0.5			Some Coleopterans - mostly unidentified debris
5-14-70	II-7				2.4			Hymenopterans (small "wasps"), coleopterans and trichopterans w/cases of wood
5-13-70	II-5			BT	2.3			mostly trichopterans, several winged "ants", and two Coleopterans noticed
5-13-70	II-4			BT	1.1			several small coleopterans + some small aquatics
5-13-70	II-3			BT	1.0			mostly Coleopterans
5-13-70	II-2			RT	1.8			mostly trichoptera larvae(?) + Spiders Coleopterans, Hymenopterans, and Dipterans
5-13-70	II-1			RT	4.0			many Coleopterans and some trichoptera larvae (?)

STATIONARY SAMPLES

1. DOCUMENT STATION 1-10

DATE	STATION	LOCATION	DEPTH	SPECIES	WATER	TEMP	WIND	WAVE
4-29	II-1	SNF	35	RT	1.0	200	1/16	200-250
"	II-2	"	"	RT	1.1	205	1/16	"
"	II-3	"	"	BT	.8	205	2/32	"
4-30	II-1	1st stage sta. below dam	"	BT	1.4	312	1/4	Gill Net
"	II-2	"	"	BT	7.2	288		Gill Net
"	II-3	"	"	"	1.6	274		" "
"	II-4	"	"	"	1.5	325		" "
"	II-5	"	"	"	empty	302		" "
"	II-6	"	"	"	.7	258		" "
"	II-7	"	"	RT	??	242		" "
"	II-8	"	"	"	.4	236		" "

Thul River, Preston Mdws. below Preston Falls
8/3/72 - 8/22/72

RYAN INSTRUMENTS, INC.
SEATTLE, WASH.
SERIAL NO. 810-1

INSTR. NO. 7930

DATA:

Thermo 2-5-72
11:50 W. 20-66°F

CALIBRATED
TEMP. SCALE

DAYS

8/22/72
63°F

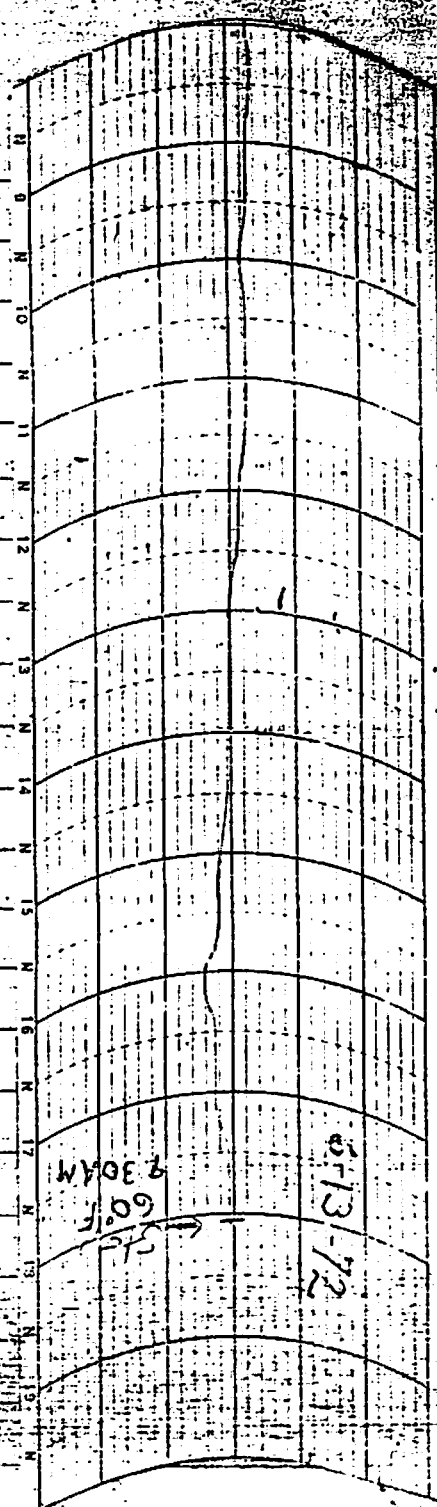
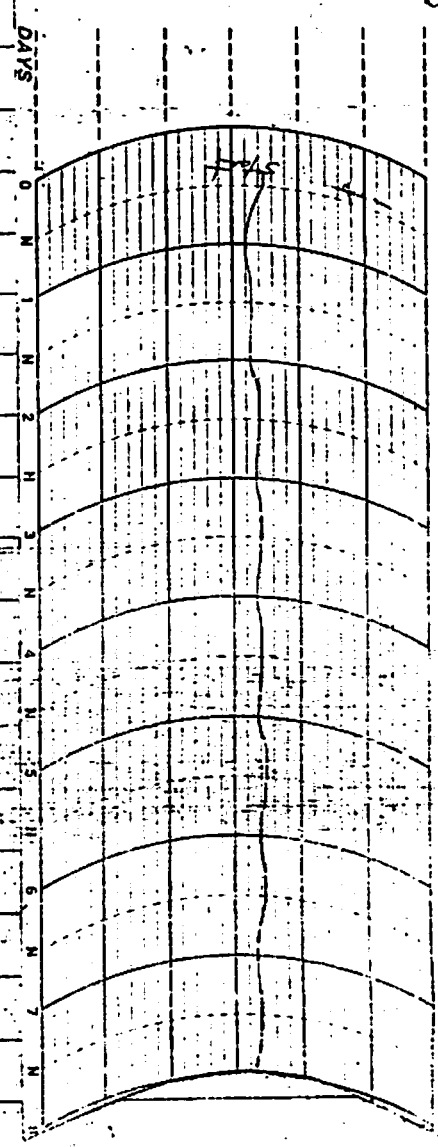
Tide River, Foster, Idaho, below Snake Falls
5/26/72 - 6/13/72

RYAN INSTRUMENTS, INC.
 SEATTLE, WASH.
 CHART NO. 49-1

INSTR. NO. 7930

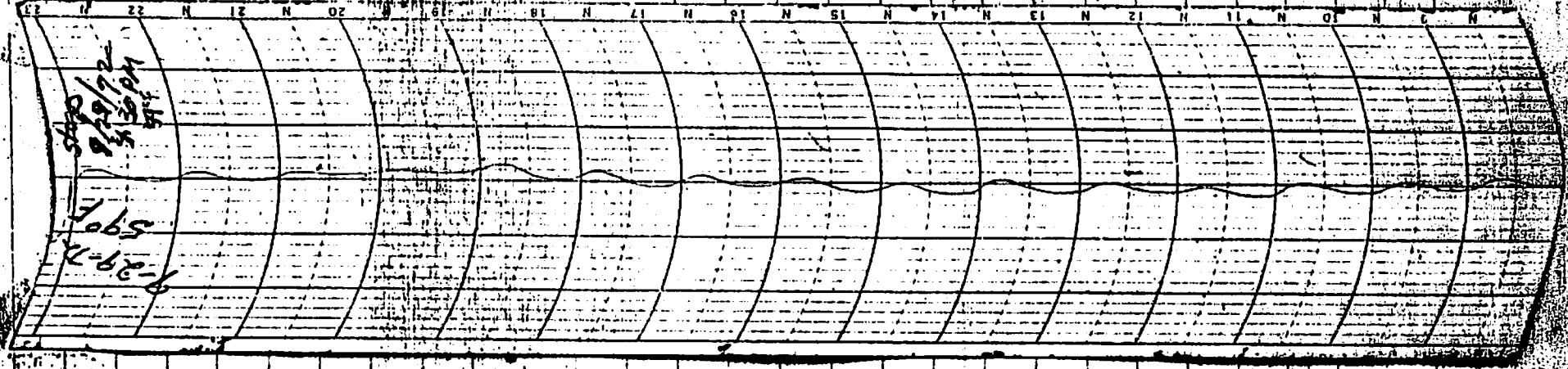
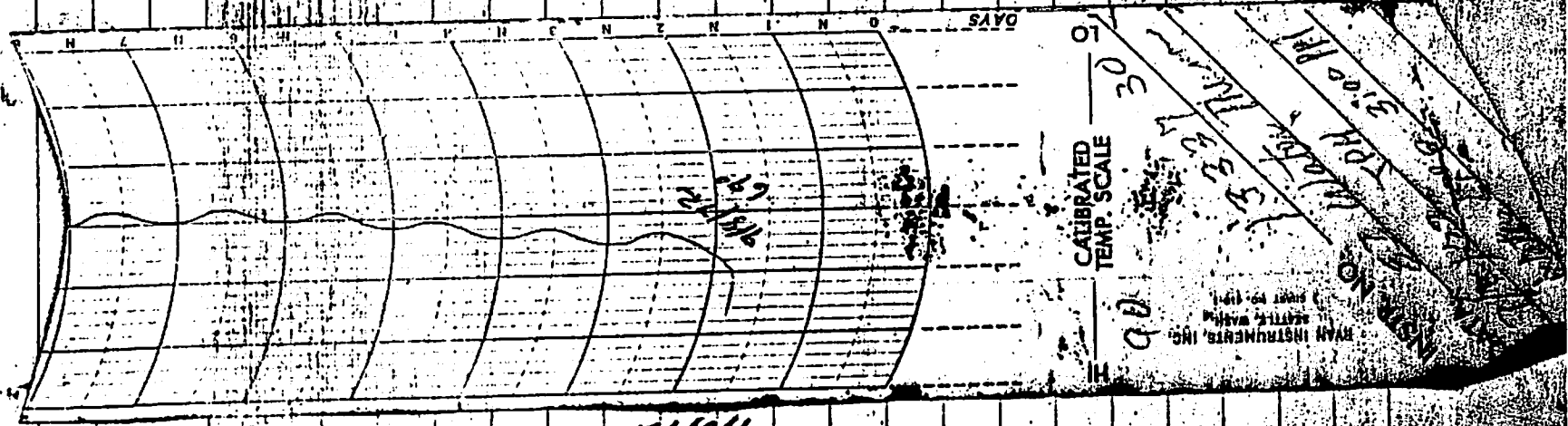
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 60° F. 1050 ft.
 1050 ft. 1050 ft.
 1050 ft. 1050 ft.
 1050 ft. 1050 ft.

00° 30' - 90°
 CALIBRATED TEMP. SCALE
 OF 30°

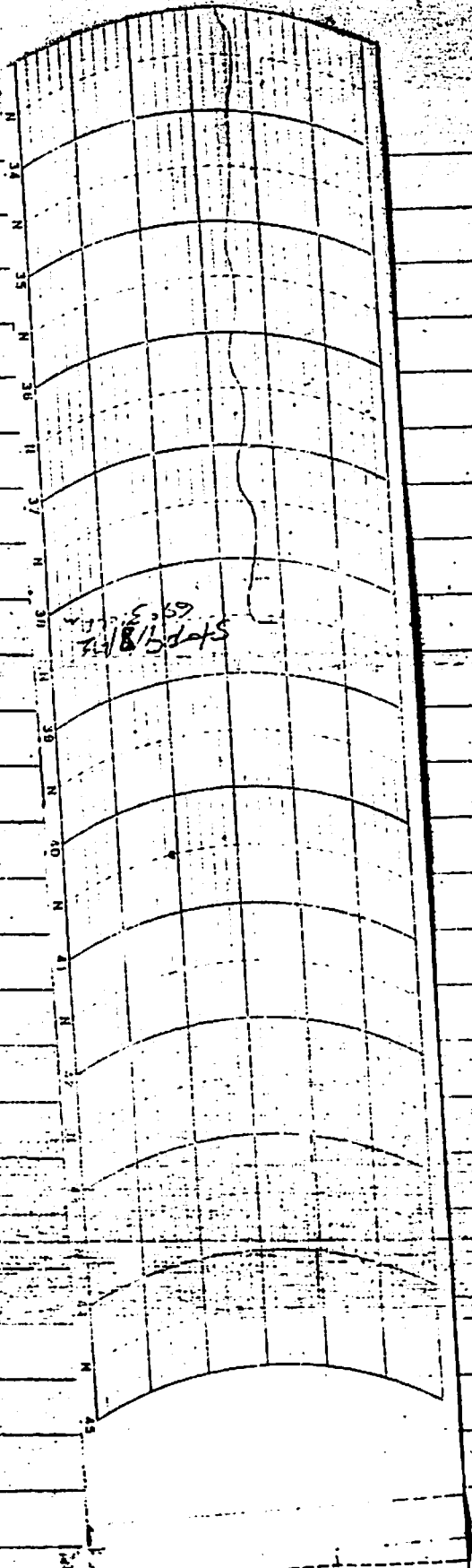
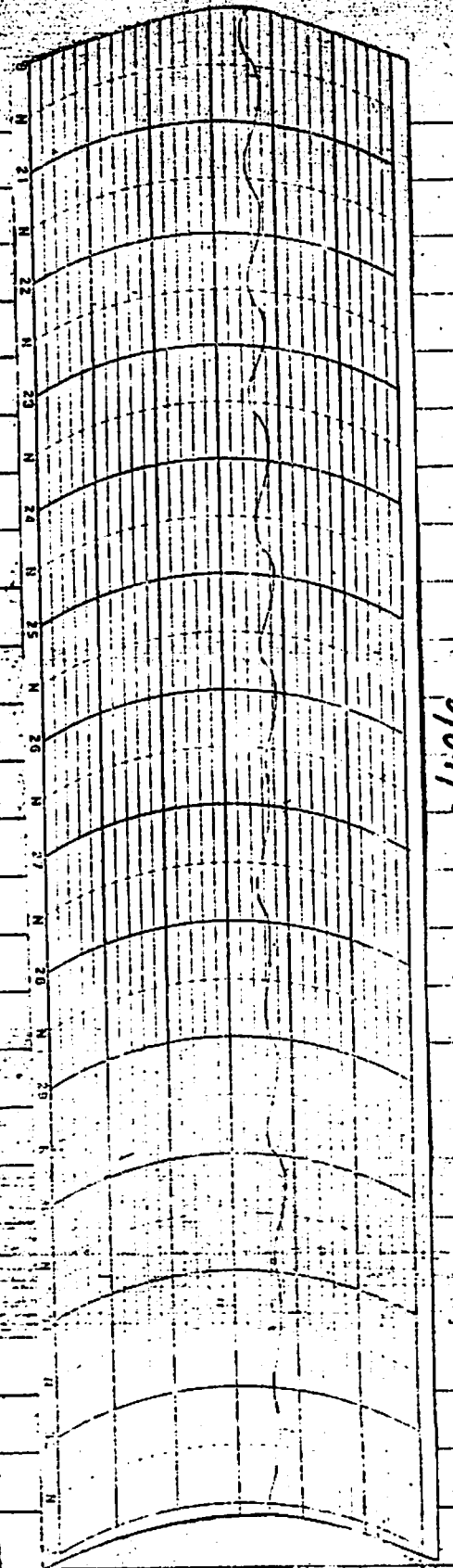


11/2/75
gnd

*Two River above early Intake gage station
9/8/72*

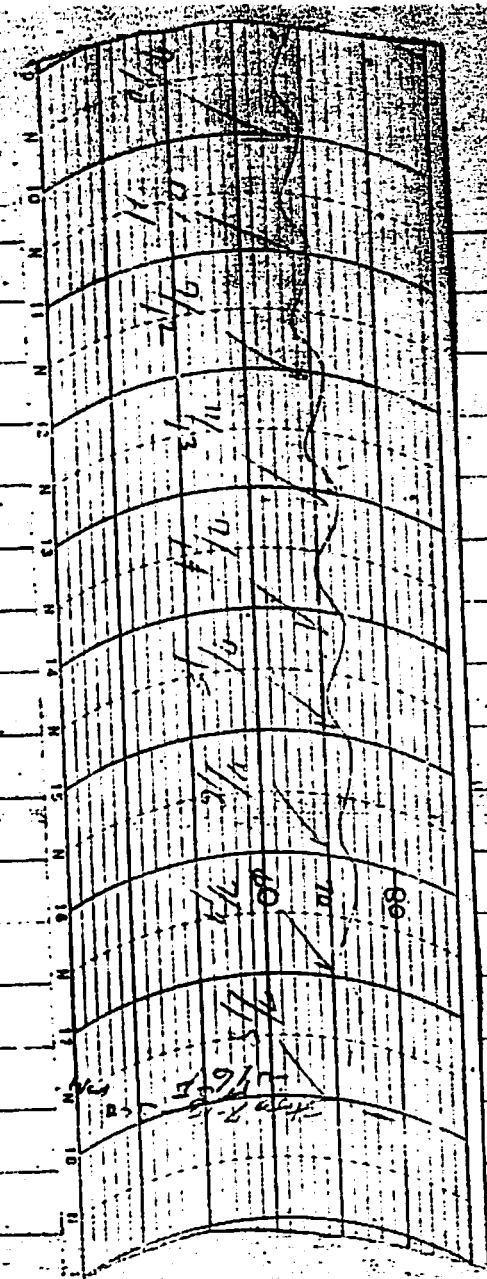
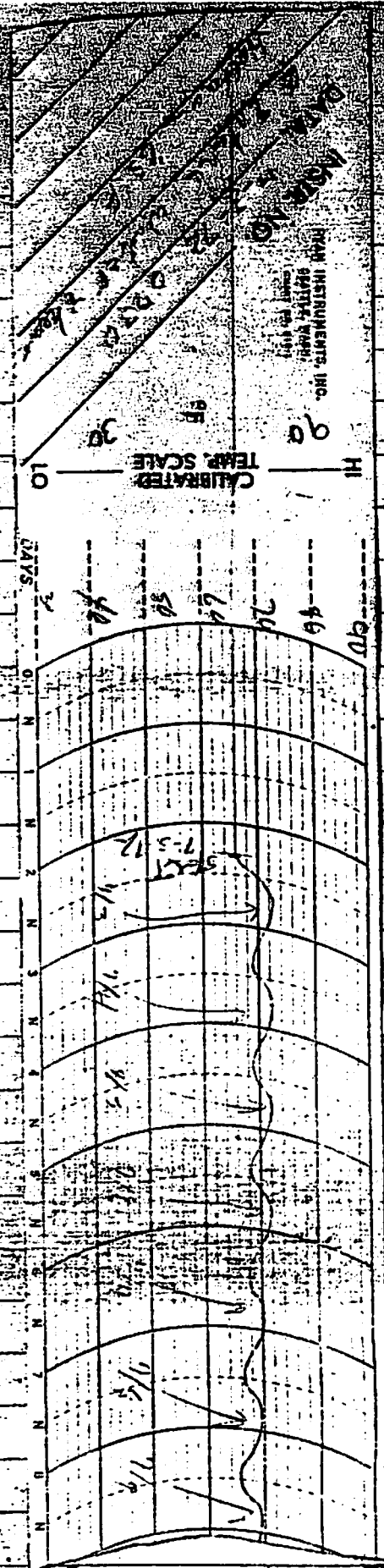


Tue. River at Cape above early intake
8/21/72 - 9/8/72



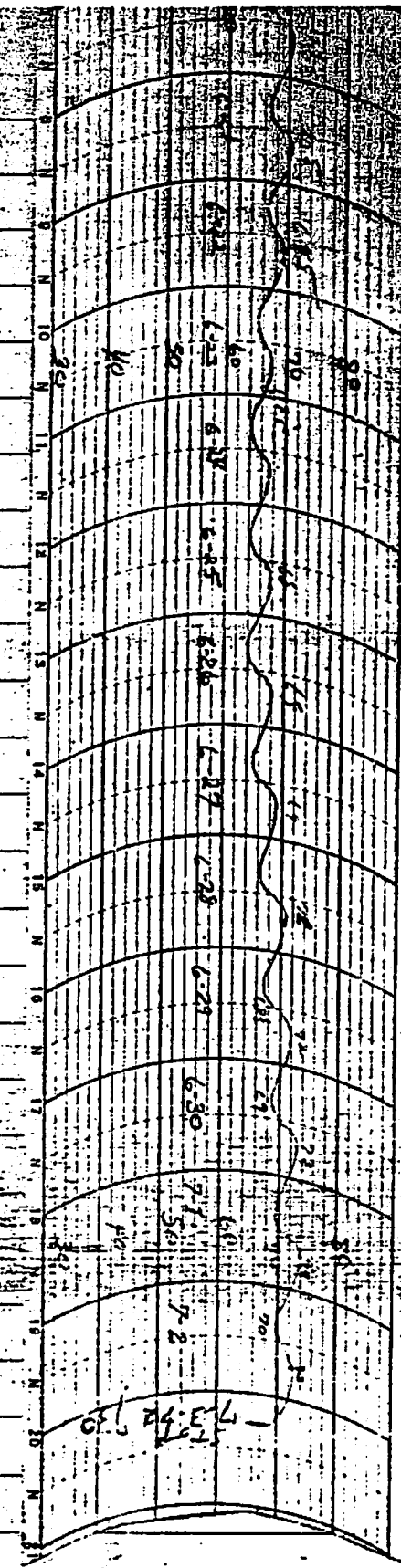
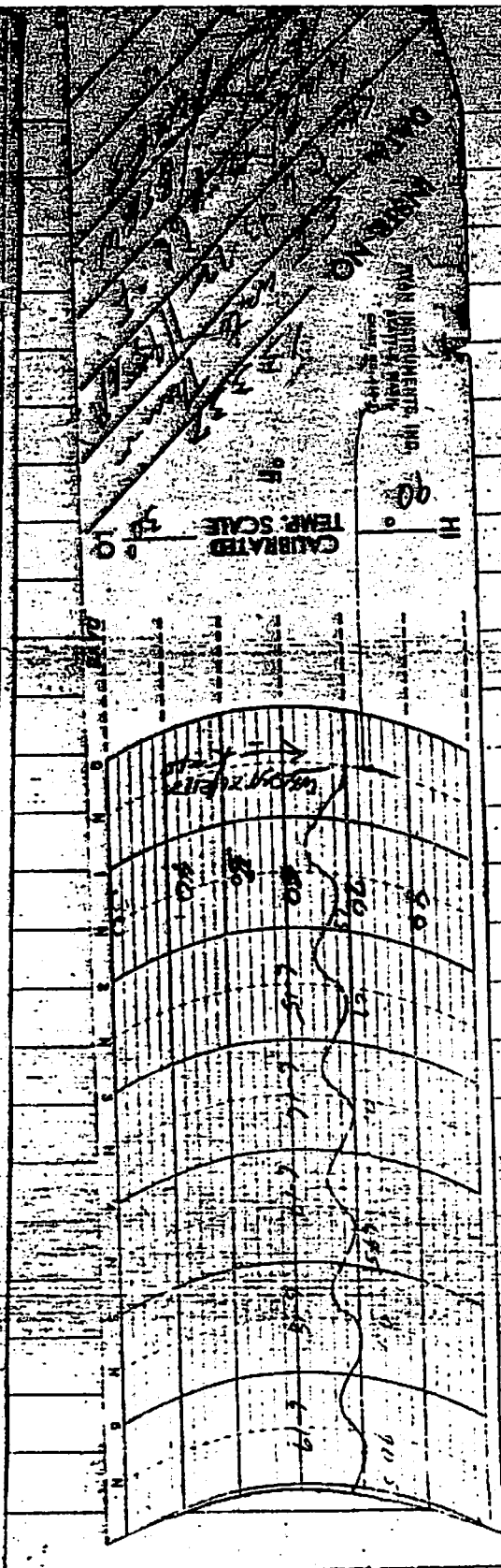
1-18-75
9/2/76

Tuck, River, Ga. 1/4 mile Coy Station above Sandy Springs
 7-3-72 / 7-14-72



1-10-78
 998

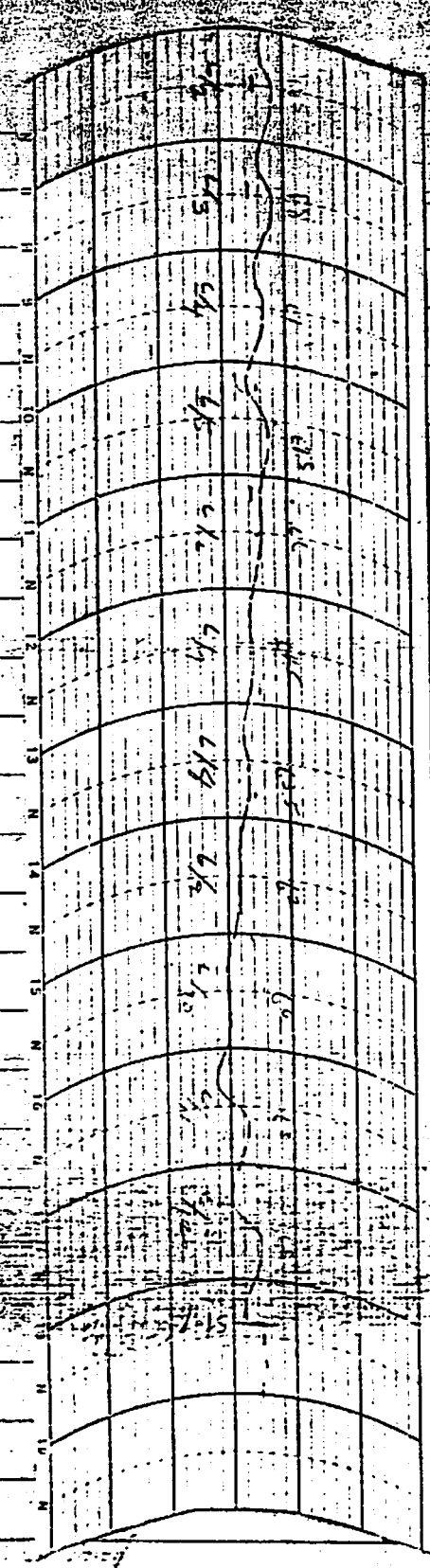
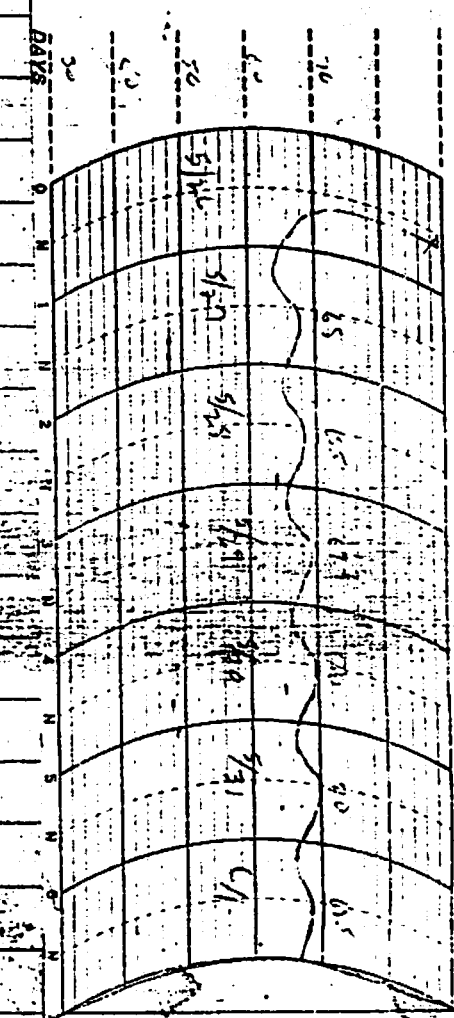
Twp. 2. River, Back Imber Gage Station
 6-13-72/7-3-72
 Initial



204
 1-10-78

Tuol. River, Early Inflow Gauge 54 ft above Early Intake
5-26-72 / 6-13-72

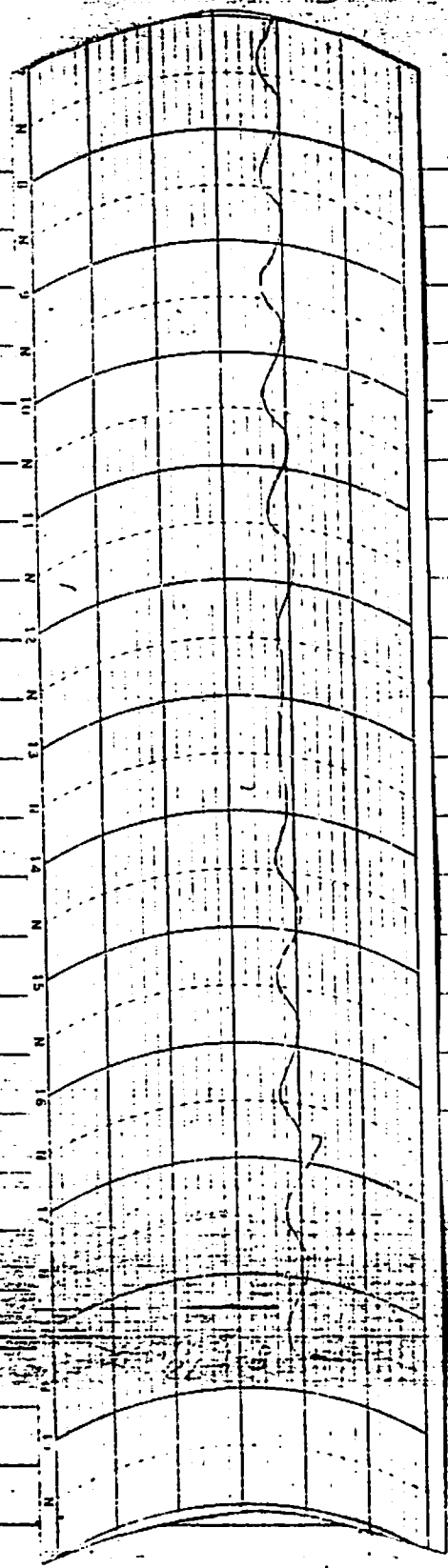
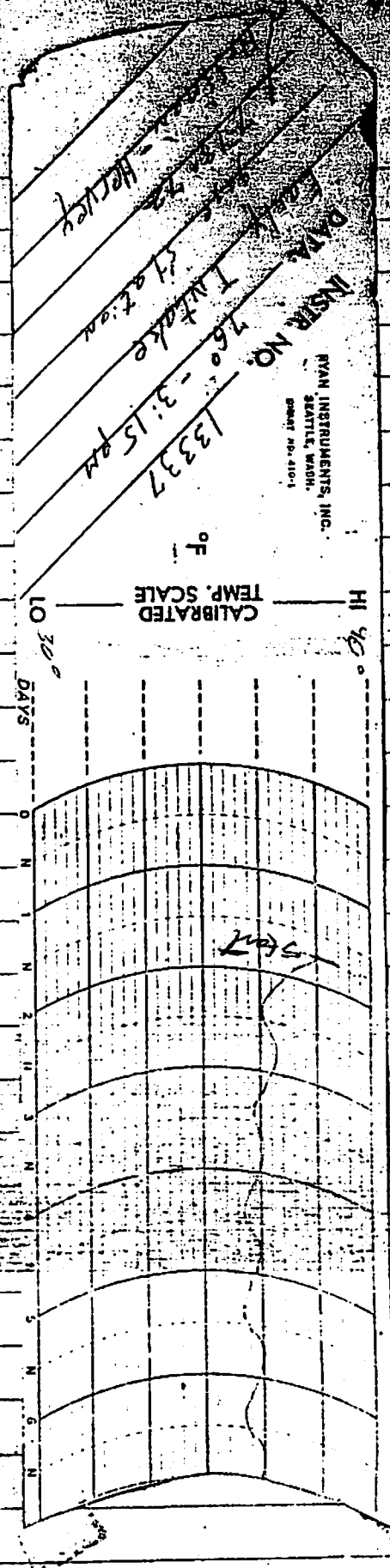
DATE: 5-26-72
 INSTRUMENT NO. 13321
 FROM: 54 ft above Early Intake
 TO: 500 ft above
 30-90°
 CALIBRATED TEMP. SCALE



90H
1-10-78

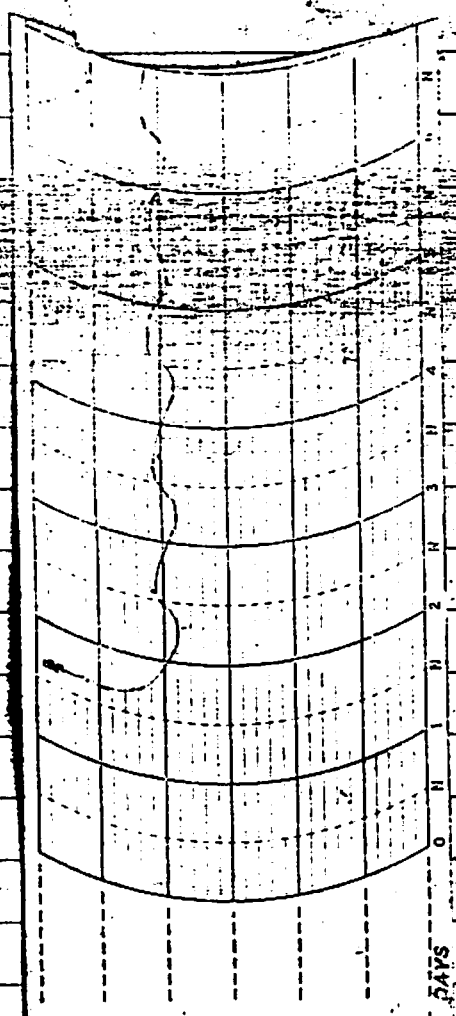
Tule River, Early Tule River Gauge Station above Early Intake

7-19-72 / 8-4-72

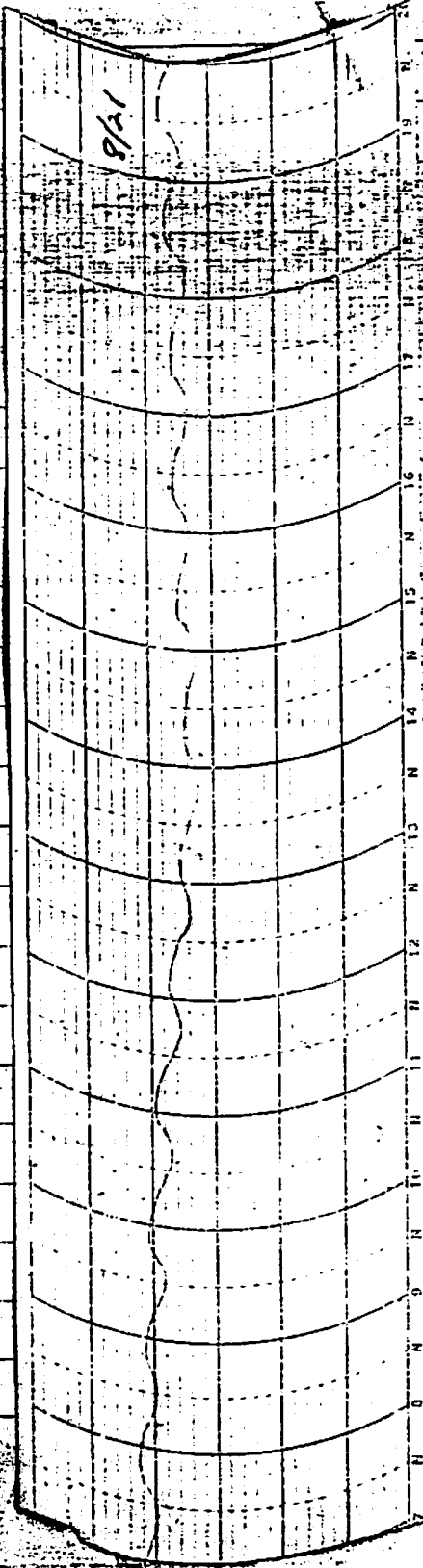


1-10-79
gph

Tul. River at Gage above Empty Tank
 8-4-72/8-21-72



HI 70 CALIBRATED TEMP. SCALE 70 LO
 °F
 RYAN INSTRUMENTS, INC.
 SEATTLE, WASH.
 CHART NO. 410-1
 INSTR. NO. 2-4-12
 DATA: Empty Tank
 Water Temp
 Temp to F 5:00 PM



9/21

1-10-79
 906

Temperature Record - 1968

Inst # 9088

No.	Day	Month	Year	Time	Temp	Humidity	Wind	Clouds	Remarks
	June 1	20	1968	13 days	27 days	3 days	4 days	5 days	6 days
	High	Low	High	Low	High	Low	High	Low	High
30-39°F	0	0	0	0	0	0	0	0	0
40-49°F	0	0	0	0	0	0	0	0	0
50-59°F	3	11	0	1	1	5	8	11	21
60-69°F	15	7	26	29	24	26	22	11	0
70-79°F	0	0	5	1	6	0	0	0	0
80-89°F	0	0	0	0	0	0	0	0	0
Above 90°F	0	0	0	0	0	0	0	0	0

Monthly Hi Lo
AUG

62.2 59.3 67.5 69.4 65.9 62.1 63.0 61.3 52.8 51.9 42.9

1 may. 70°F

TRAHH - 1968
H2O

DATE	MAX	MIN	FLUKE	DATE	MAX	MIN	FLUKE
Instrument # 9000							
June 13	56°			July 21	65°	64°	
14 (100) 58°	(200) 54°			22 (100) 65°	(200) 64°		
15 (100) 60°	(200) 56°			23		64°	
16 (200) 61°	(200) 58°			24	64°	61°	
17 (0100) 59°	(1200) 58°						
18 (2100) 62°	(1200) 59°						
19 (2000) 61°	(1100) 60°						
20 (1900) 61°	(1000) 59°						
21 (1800) 61°	(1000) 58°						
22 (1700) 61°	(0900) 57°						
23 (1700) 64°	(0900) 61°						
24 (1800) 64°	(1000) 61°						
25 (1100) 65°	(0900) 61°						
26 (1800) 66°	(0900) 62°						
27 (1700) 67°	(0900) 63°						
28 (1600) 65°	(0900) 62°						
29 (1700) 62°	(0900) 59°						
huc 62.2° 30 (1700) 63°	(0900) 58°	huc 59.3°					
July 1	(1700) 64°	(0900) 59°					
2 (1800) 64°	(0800) 60°						
3 (1800) 65°	(0800) 60°						
4 (1700) 67°	(0900) 61°						
5 (1700) 68°	(0900) 64°						
6 (1500) 65°	(0900) 64°						
7 (1500) 65°	(0900) 62°						
8 (1600) 64°	(0800) 63°						
9 (1600) 66°	(0900) 62°						
10 (1600) 64°	(0900) 61°						
11 (1500) 66°	(0900) 61°						
12 (1600) 66°	(0800) 62°						
13 (1600) 67°	(0800) 63°						
14 (1600) 68°	(0800) 63°						
15 (1600) 69°	(0800) 64°						
flume 16 (1600) 69°	(0800) 64°	132 cfs	air 76°F huc 55°F @ 1018 huc; 3.74				
17 (1500) 68°	(0700) 63°						
18 (1500) 69°	(0700) 63°						
19 (1600) 69°	(0700) 64°						
20 (1700) 69°	(0700) 64°						

STATION

TR. above Hatch Hatchy (HSD)

DATE 6-25-57

TIME 7:05

DATE		Remarks	TEMP. °F MAX. TIME	TEMP. °F MIN. TIME	Flow
July	23	Flow measured	70° 6:30 (max)	64	Flow 32 cfs; sta. gauge is 16' high
	24		70	65 6:30 (max)	Flow 32 cfs; sta. gauge is 16' high
	25		70	65	Flow 32 cfs; sta. gauge is 16' high
	26		71	66	Flow 32 cfs; sta. gauge is 16' high
	27		69	67	Flow 32 cfs; sta. gauge is 16' high
	28		68	67	Flow 32 cfs; sta. gauge is 16' high
	29		70	66	Flow 32 cfs; sta. gauge is 16' high
	30		67	67	Flow 32 cfs; sta. gauge is 16' high
	31	Flow 67.5	67	65 6:34	Flow 32 cfs; sta. gauge is 16' high
Aug.	1		69	65	Flow 32 cfs; sta. gauge is 16' high
	2		70	66	Flow 32 cfs; sta. gauge is 16' high
	3		70	66	Flow 32 cfs; sta. gauge is 16' high
	4		69	65	Flow 32 cfs; sta. gauge is 16' high
	5		69	65	Flow 32 cfs; sta. gauge is 16' high
	6		70	65	Flow 32 cfs; sta. gauge is 16' high
	7		68	66	Flow 32 cfs; sta. gauge is 16' high
	8		69	66	Flow 32 cfs; sta. gauge is 16' high
	9		70	66	Flow 32 cfs; sta. gauge is 16' high
	10		70	67	Flow 32 cfs; sta. gauge is 16' high
	11		70	66	Flow 32 cfs; sta. gauge is 16' high
	12		69	66	Flow 32 cfs; sta. gauge is 16' high
	13		66	65	Flow 32 cfs; sta. gauge is 16' high
	14		65	62	Flow 32 cfs; sta. gauge is 16' high
	15		66	62	Flow 32 cfs; sta. gauge is 16' high
	16		65	63	Flow 32 cfs; sta. gauge is 16' high
	17		65	61	Flow 32 cfs; sta. gauge is 16' high
	18		62	62	Flow 32 cfs; sta. gauge is 16' high
	19		61	61	Flow 32 cfs; sta. gauge is 16' high
	20		60	60	Flow 32 cfs; sta. gauge is 16' high
	21		58	58	Flow 32 cfs; sta. gauge is 16' high
	22	Flow measured	60	55	Flow 32 cfs; sta. gauge is 16' high
	23		62	58	Flow 32 cfs; sta. gauge is 16' high
	24		63	59	Flow 32 cfs; sta. gauge is 16' high
	25		61	60	Flow 32 cfs; sta. gauge is 16' high
	26		62	58	Flow 32 cfs; sta. gauge is 16' high

↓ Flow 32 cfs; sta. gauge is 16' high
 just 58°F air 73°F
 @ 1500 hrs.

STATION

T.R. above Hetch-Hetchy (H.O.)

Station 21354

Inst. - 7087

DATE	Remarks	Temp AIR	Time	Temp AIR	Time	Flow
Aug. 27		64	(1000-1100)	60	(1000-1100)	
28		62		62		
29		68		64		
30		69		66		
31		68		67		
Sept. 1	thermometer	69		67		
2	repaired therm	68		68		
3	inst. at	68		65		
1000 miles (4)	end of 44 days	68		65		28 5/8
5		67	(1800)	65	0900-1100	left 6.00 AM 15
6		68		65		left 6.50 PM 15
7		67		65		
8		67		65		
9		67		65		
10		66		64		
11		65		63		
12		65		63		
13		64		63		
14		64		62		
15		63		62		
16		63		61		
17		63		61		
18		63		62		
19		63		62		
20		58		58		storm
21		57	1500-1800	56	1000-1200	
22		58		55		
23		57		55		
24		58		56		
25		59		57		
26		60		58		
27		60		59		
28		60		59		
29		58	1890 total	58	1935 total	
30		57	avg 63.0	56	avg 61.3	

T.R. above Hatch-Hatchy

Water Temperature

June 7 1948

Chart 03340

DATE	WATER TEMPERATURE				REMARKS - FLOW
	MAX	(Time)	MIN	(Time)	
Oct. 1	58	(1800)	57	(1200)	chart about 6 m. just the same
2	59		57		
3	57		57		
4	58		57		
5	58		57		
6	57		57		
7	56		56		
8	55		54		
9	55		53		
10	55		54		
11	55		54		
12	53		53		
13	52		53		
14	52		52		
15	51		47		cf/w meas. taken; Chart 03340
16	50	0100	49	(1100-1200)	installed 1130hrs air 55°F
17	50		49		Had 47°F, staff gauge 6.44
18	51		50		flow 57 cfs
19	50		49		
20	50		49		
21	50		49		
22	50		49		
23	51		49		
24	51		50		
25	51		50		
26	51		50		
27	51		50		
28	51		50		
29	51		51		
30	49		49		
31	48	1630 HRS	47		1630 HRS
avg	52.8		51.9		avg.

Water Thermograph

Inst. No. 103

Lat. 33° 30' N

T.R. above Held-Heldy

WATER TEMPERATURE

DATE	mor.	Even.	Nite.	(Time)	Remarks - Place
Nov. 1	47	(@100)	47	(@100)	
2	48		47		
3	47		46		
4	44		45		
5	45		47		
6	44		47		
7	45		47		
8	45		47		
9	46		45		
10	46		46		
11	47		46		
12	44		43		
13	41		46		
14	39		38		
15	40		38		
16	41		40		
17	42		41		
18	44		42		
19	42		41		
20	42		41		
21	42		41		
22	42		42		
23	42		42		
24	41		41		
25	39		39		
26	39		37		
27	39		38		
28	37		36	1155 AM	end 45-day period

avg

42.9

1200 AM

42.0

avg

thermograph removed

12-7-68

air temp 33°F, H₂O temp built 33

(@) 1200 still came 3.52 est time

T-1 Air Temperature

June 1967

days/month temp. occurred each °F range

Air Temp

June ^{18 days}
max min

July ^{31 days}

Aug ^{31 days}

Sept ^{30 days}

Oct ^{31 days}

Nov ^{30 days}

30-39.9

0 0 0 0 0 0 0 0 0 0

40-49.9

0 0 0 0 0 0 0 0 0 0

50-59.9

0 6 0 1 0 11 0 17 5 11 8

60-69.9

0 11 0 25 4 11 2 11 4 0 5

70-79.9

1 0 0 5 8 1 5 0 18 0 0

80-89.9

10 0 14 0 10 0 15 0 4 0 0

>90

7 0 17 0 9 0 8 0 0 0 0

Monthly
avg

86.7 60.8 88.0 68.8 81.1 60.1 83.6 57.4 70.6 48.0 58.0 94.4

AD

1-7-69

T-1 air 1968

DATE	TIME	TEMP	WIND	WIND	WIND
JUNE 13	85°	(1500)	60°	(0700)	
JUNE 14	82°	(1500)	58°	(0720)	
JUNE 15	86°	(1500)	58°	(0700)	
JUNE 16	90° + 3 hrs	(1500)	62°	(0700)	
JUNE 17	86°	(1400)	62°	(0700)	Average
JUNE 18	89°	(1500)	63°	(0630)	WIND - 1.1 ft
JUNE 19	87°	(1500)	62°	(0530)	
JUNE 20	87°	(1330)	60°	(0700)	AVERAGE
JUNE 21	90° + 3 hrs	(1300)	58°	(0700)	
JUNE 22	90°	(1300)	61°	(0730)	
JUNE 23	87°	(1500)	62°	(0700)	
JUNE 24	90° + 3 hrs	(1130)	57°	(0700)	
JUNE 25	90° + 5 hrs	(1130)	64°	(0700)	
JUNE 26	90° + 6 hrs	(1100)	66°	(0600)	
JUNE 27	90° + 6 hrs	(1130)	67°	(0600)	
JUNE 28	84°	(1230)	61°	(0700)	
JUNE 29	77° Ave	(0400)	58° Ave	(0600)	
JUNE 30	82° 86.7	(1300)	58° 60.8	(0630)	
JULY 1	88°	(1400)	58°	(0700)	
JULY 2	85°	(1330)	62°	(0800)	
JULY 3	87°	(1400)	60°	(0700)	
JULY 4	90° + 4 hrs	(1300)	63°	(0630)	
JULY 5	90° + 7 hrs	(1200)	66°	(0800)	
JULY 6	90° + 4 hrs	(1130)	68°	(0700)	
JULY 7	88°	(0600)	70°	(0600)	
JULY 8	84°	(1300)	68°	(0700)	
JULY 9	84.5°	(1500)	68°	(0730)	
JULY 10	90° + 3 hrs	(1430)	64°	(0700)	
JULY 11	90° + 5 hrs	(1400)	65°	(0830)	
JULY 12	89°	(1500)	66°	(0800)	
JULY 13	84°	(1530)	64°	(0800)	
JULY 14	83°	(1600)	63°	(0800)	
JULY 15	82°	(1500)	63°	(0800)	
JULY 16	84°	(1400)	62°	(0730)	
JULY 17	88°	(1700)	61°	(0730)	
JULY 18	90° + 4 hrs	(1400)	64°	(0800)	
JULY 19	90° + 7 hrs	(1430)	64.5°	(0800)	
JULY 20	90° + 6 hrs	(1430)	66°	(0730)	
JULY 21	90° + 5 hrs	(1430)	65°	(0900)	
JULY 22	90° + 7 hrs	(1400)	64°	(0900)	
JULY 23	90°	(1500)	65°	(0900)	Removal + 1535h

STATION
T-1 (Air)

DATE 4-23-51
TIME 11:41

DATE	REMARKS	Temp. F. MAX.	Time	Temp. F. MIN.	Time	Flow
July 23			(1800)-(1900)			75 cfs
24		> 90		64	(1000)	
25		> 90		65		
26		> 90		66		
27		> 90		68		
28		> 90		71		
29		> 90		70		
30		87	↓	74	↓	
31		85	2000	72	↓	
	Ave -	88.0		Ave -	68.8	
Aug. 1		89	1900	67	(1000)	
2		90	(1900)-(2000)	67		
3		90	↓	67		
4		90		64		
5		88		64		
6		> 90		63		
7		> 90		64		
8		88		69		
9		90		69		
10		88	↓	71	↓	flow change to 731 cfs (osc)
11		85	(1900)	63	(1100)	flow change 11 pm to 1.50 cfs
12		83	(1800)	64		
13		68	2000	63		
14		71	(1900)-(2100)	54		
15		76	↓	56		
16		73		60		
17		75		55		flow change 11:30 AM 1250
18		70	↓	57	↓	
19		64	(1800)	63	(1400)	
20		63	(2100)	55	(1300)	
21		61	(1700)	48	(1100)	
22		71	(1900)-(2100)	45		flow change 11:30 AM 100 cfs
23		79	↓	51	↓	
24		83	↓	54		

STATION
T-1 (Air)

Aug 24 1957
10:00

DATE	Remarks	Temp. F° MAX	Time	Temp. F° MIN	Time	Flow
Aug 26		82	(1100-1200)	52	(1200-)	Working with engine
27		83		54		25 gph
28		88		57		
29		> 90		62		
30		> 90		64		
31		> 90		66		
	Avg =	81.1		Avg =	60.1	
Sept 1		> 90	(1100-1200)	68	(1200-)	25 gph
2		90		62	(1400)	
3	Removal	87		61		
4	1600 hrs.	> 90		61		Reheat 03221 installed
5		> 90	(1200-1500)	62	(0600)	1000 gph air 90°F. fuel
6		> 90		62		Flow change to 1700 gph
7		> 90		63		35 gph
8		> 90		63		
9		87		63		
10		86		60		
11		85		59		
12		85		58		
13		83		57		
14		78		59		
15		80		55		
16		83		57		
17		87		57		
18		86		59		
19		74		59		
20		65		52		
21		68		47		
22		75		45		
23		86		51		
24		86		57		
25		88		53		
26		90		55		
27		87		56		

AIR TEMPERATURE					
DATE	AIR	TIME	AIR	TIME	REMARKS - FAN
Sept. 28	83	1800-1900	55		35 f
29	74		60		
30	75		53		
Oct 1	83		57		
Oct 1	74	1400-1500	52	0600-0800	35 f
2	79		52		
3	75		52		
4	75		53		
5	75		52		
6	72		52		
7	70		49		
8	71		45		
9	73		49		
10	75		49		
11	70		52		
12	62		55		
13	55		49		
14	55		50		
15	62		41		
16	67		43		
17	74		46		→ Chart 02998 installed 1500h 75°F air bulb
18	69		46		
19	73		43		
20	71		45		
21	74		43		
22	74		42		
23	77		47		
24	80		48		
25	80		48		
26	80		49		
27	82		47		

T-1 Air

June 1961

DATE	Air Temp	Time	Humidity	Remarks
Oct. 28	79	1100-1200	50	35%
29	57		51	
30	55		44	
31	55		43	
Nov 1	56		45	
2	51		50	
3	51		49	
4	55		41	
5	58		44	
6	53		38	
7	60		43	
8	61		42	
9	66		44	
10	67		46	
11	60		45	
12	-		42	
Avg 58.0		Avg 44.0		→ and record due to water leaks into recorder; wetting chart and rigging it; instr. installed upside down 10-17-68 Therm removed 12-5-68

TEMP STATION T-1

July 1969

WATER TEMPERATURE

days / month Temp. occurred in each °F range

°F TEMP.	June	July	Aug	Sept	Oct	Nov
30-39.9	0	0	0	0	0	0
40-49.9	0	0	0	0	0	0
50-59.9	18	31	31	30	23	30
60-69.9	0	0	0	0	0	0
70-79.9	0	0	0	0	0	0
80-89.9	0	0	0	0	0	0
> 90	0	0	0	0	0	0
Monthly Avg.	54.2	51.2	54.7	52.2	54.3	53.8

|| max. water temp. during summer = 57°F

DAD

1-7-69

T-1

TEMP. STATION: TRANSLT. A1

No. of days/month temperature recorded mean
maximum temp. range

(Air vs. H₂O at T-1)

TEMP.	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	YR.
AIR (H ₂ O)								
30°-39.9°	0 (0)	0	0	0	0	0	0	0
40°-49.9	0 (0)	0	0	0	0	0	0	0
50°-59.9	0 (12)	0	31	0	31	0	5	13
60°-69.9	0 (0)	0	4	0	2	0	4	10
70°-79.9	1 (0)	0	8	6	5	0	18	0
80°-89.9	12 (0)	14	10	0	15	0	4	0
>90° 11.9	7 (0)	17	9	0	8	0	0	0

TEMP. STATION: TAYLOR #1

NUMBER OF DAYS MONTH TEMPERATURE
F. OCCURRED IN EACH RANGE

MINIMUM TEMPERATURE

(AIR vs. H₂O at 7-1)

TEMP
AIR (H₂O)

JUNE

JULY

AUG

SEPT

OCT

NOV

Air H₂O

Air H₂O

Air H₂O

Air H₂O

Air H₂O

Air H₂O

Air H₂O

Air H₂O

30-39.9°

0(0)

0

0

0

0

0

0

0

40-49.9

0(0)

0

0

2

0

2

0

0

50-59.9

6(18)

1

31

11(31)

17

30

15

23

60-69.9

11(0)

25

0

17

0

11

0

0

70-79.9

0(0)

5

0

1

0

0

0

0

80-89.9

0(0)

0

0

0

0

0

0

0

>90°F

0(0)

0

0

0

0

0

0

0

DATE	TEMPERATURE	WIND	WIND DIRECTION	WIND SPEED	WIND DIRECTION
JUNE 13	55°	(1730)	55°	(0800)	
JUNE 14	54°	(1600)	50°	(0700)	Heavy rain
JUNE 15	54°	(1745)	51°	(0740)	Heavy rain
JUNE 16	54.5°	(1600)	50°	(0700)	Heavy rain
JUNE 17	53°	(1650)	50°	(0700)	
JUNE 18	54.5°	(1730)	51°	(0740)	
JUNE 19	54°	(1700)	51°	(0700)	Heavy rain
JUNE 20	54°	(1750)	50.5°	(0750)	Heavy rain
JUNE 21	54°	(1800)	51°	(0730)	Heavy rain
JUNE 22	55°	(1800)	51°	(0730)	Heavy rain
JUNE 23	54.5°	(1830)	51°	(0730)	Heavy rain
JUNE 24	55°	(1800)	51°	(0730)	Heavy rain
JUNE 25	55°	(1800)	51°	(0730)	Heavy rain
JUNE 26	55°	(1900)	52°	(0800)	Heavy rain
JUNE 27	55.5°	(1700)	52.5°	(0800)	Heavy rain
JUNE 28	53°	(1800)	51.5°	(0830)	Heavy rain
JUNE 29	52.5° ^{avg}	(1800)	50.5°	(0700)	Heavy rain
JUNE 30	54° 54.2	(1800)	51° 51.2	(0700)	Heavy rain
JULY 1	54°	(1700)	51°	(0800)	Heavy rain
JULY 2	54°	(1800)	51° - 6/10	(0900)	Heavy rain
JULY 3	54°	(1700)	51°	(0830)	Heavy rain
JULY 4	55°	(1750)	52°	(0800)	Heavy rain
JULY 5	55.5°	(1530)	52°	(0800)	Heavy rain
JULY 6	55°	(1600)	52.5°	(0630)	Heavy rain
JULY 7	54°	(1630)	53°	(0900)	Heavy rain
JULY 8	54°	(1500)	53°	(0930)	Heavy rain
JULY 9	55°	(1630)	53°	(0700)	Heavy rain
JULY 10	55°	(1700)	52°	(0900)	Heavy rain
JULY 11	54.5°	(1700)	52°	(1000)	Heavy rain
JULY 12	55°	(1630)	52°	(0930)	Heavy rain
JULY 13	54.5°	(1800)	52°	(1000)	Heavy rain
JULY 14	54.5°	(1850)	52°	(1000)	Heavy rain
JULY 15	55°	(1850)	52°	(1000)	Heavy rain
JULY 16	55°	(1900)	52°	(0730)	Heavy rain
JULY 17	54.5°	(1850)	51.5°	(1000)	Heavy rain
JULY 18	55°	(1850)	52°	(1030)	Heavy rain
JULY 19	55°	(1930)	52°	(0700)	Heavy rain
JULY 20	55°	(1900)	52°	(1100)	Heavy rain
JULY 21	54.5°	(1700)	52°	(0900)	Heavy rain
JULY 22	54.5°	(1900)	52°	(1130)	Heavy rain
JULY 23	55°	(1500)	52°	(1130)	REMOVED AT 1500 HRS,

STATION

T-1

(H₂O)

Chart # 03115

Date 8-29

DATE

Remarks

Temp. F°
Min.

Time

Temp. F°
Min.

Time

Flow

July	23	put in at					
	24	1500 hrs.	56	(1800)-(2000)	53	1700	75 cfs
	25		56		53	1700	
	26		55		53	1700	
	27		55		53		
	28		54		53	(0900-1100)	
	29		56		53		
	30		55		53		
	31		55		53		
			Ave 54.7		Ave 52.2		
Aug.	1		56		53	(0900-1100)	
	2		56		53		
	3		55		53		
	4		55		53		
	5		55		53		
	6		55		53		
	7		55		53		
	8		56		53		
	9		56		54		
	10	thermo pulled 1800hrs 8-9-68					400 cfs 0800 8-10-68 730 cfs 1400 8-10-68 150 cfs 2300 8-10-68 730 cfs 1400 8-11-68 150 cfs 2300 8-11-68
	11						
	12	Start flow study					
	13		54	(1800)-(2000)	53	(0900-1100)	
	14		53		52		
	15		53		52		
	16		53		52		
	17		53		52		Flow change to 125 cfs 0800 hrs.
	18		52		52		
	19		53		52		
	20		53		52		
	21		52		52		
	22		53		52		Flow change to 100 cfs 0800 hrs.
	23		54		52		
	24		54		52		
	25		53		52		

STATION

T-1 (H.C.)

Chart = 53155

Date 9037

DATE	Remarks	Temp. F° MAX.	Time	Temp. F° MIN.	Time	Flow
Aug. 26		54	(1800-2000)	52	(0900-1100)	Flow change to 25 cfs. 1830 hrs.
27		54		52		
28		55		53		
29		56		53		
30		56		53		
31		55		54		Flow change to 50 cfs. 1745 hrs.
		Aug 54.3		Aug 52.5		
Sept. 1		56		54		
2		56		53		
3	Chart 53122 Taken out	56		53		
chart changed → 4	1400 hrs Water temp 55°F	56		54		50 cfs.
5		56	(1900-2100)	54	(0900-1100)	Flow change to 35 cfs. 1730 hrs.
6		56		54		
7		56		54		
8		57		55		
9		56		55		
10		56		54		
11		56		54		
12		56		54		
13		55		54		
14		55		54		
15		55		54		
16		55		54		
17		56		54		
18		56		54		
19		55		54		
20		54		53		
21		53		52		
22		53		52		
23		54		52		
24		55		53		
25		55		53		
26		55		54		
27		55		54		
28		55		53		

STATION T-1 (N-0)

Index 943

WATER TEMPERATURE

DATE

MAX.

(Time)

MIN

(Time)

Remed - Flow

Sept 29
30

54

(1800-2000)

53

(1000-1200)

35 gph

55

1165 Hrs

53

1145 Hrs

avg

55.3

53.6

1

55

(1800-2000)

53

(1000-1200)

2

55

54

3

56

54

4

56

55

5

55

54

6

55

54

7

55

54

8

54

53

9

54

53

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

31

54

(2000-2400)

54

(1100-1300)

55

54

55

54

55

54

55

54

55

54

55

55

55

55

55

55

56

55

56

55

55

55

1248 Hrs

55

55

1266 Hrs

55

55

55.0

54.3

instr. malfunction

chart moist - failed
to unrollchart removed; malfunctioned, due
to improper insertion or moisture
damage onto chart causing and
failure to unroll.

1530 hrs Hrs temp built 55.5°F

staff gauge 1.34, flow 30 gph

chart 03378 installed.

1140

23 days

STATION T-1 (HID)

T-1-1-1

WATER TEMPERATURE

MAX. (Time)

MIN (Time)

Remarks - Flow

NOV. 1 55 (2000-2000) 51 (2000-2000)

2 55 51

3 55 51

4 55 51

5 55 51

6 55 51

7 55 51

8 55 51

9 56 51

10 56 51

11 55 51

12 55 51

13 54 54

14 53 53

15 53 53

16 54 53

17 54 54

18 55 54

19 54 53

20 53 53

21 53 53

22 53 53

23 53 53

24 53 53

25 52 52

26 52 51

27 52 51

28 51 51

29 51 51

30 51 51

1405 total

Avg 53.8

53.5 Avg.

End 45-Day Record

instr. removed 12-5-68
 1400 hrs Hid Temp 50°F; air 51°F
 3200 hrs thermos chain soiled around

1-5-67 (DAD)

TEMP. STATION - Payson Valley Date #6763 WATER TEMPERATURE

days/month temp. occurred in each °F range.

°F Temps	14 days AUG		30 days SEPT		31 days OCT		30 days NOV	
	Max	Min	Max	Min	Max	Min	Max	Min
30-39.9	0	0	0	0	0	0	0	0
40-49.9	0	0	0	0	0	0	0	0
50-59.9	16	17	20	23	31	31	30	30
60-69.9	3	2	10	7	0	0	0	0
70-79.9	0	0	0	0	0	0	0	0
80-89.9	0	0	0	0	0	0	0	0
>90	0	0	0	0	0	0	0	0

Monthly Avg.	57.4	56.8	58.5	57.7	57.0	56.6	54.2	50.5
--------------	------	------	------	------	------	------	------	------

Monthly Avg.
Temp °F

1) max. water temp. recorded was 64°F

P.V. H₂O - 1968

Station Below T-3 Pampas Valley (H₂O) Chart 002979 June 1963

DATE	Remarks	Temp F Max	Temp F Time	Temp F Max	Temp F Time	Flow
Aug. 12	Foot 120					150 cfs
13	1500 hrs.	58	(1900-2100)	57	(1900-2100)	
14		57		56		
15		57		56		
16		57		57		
17		57		56		
18		56		56		
19		56		56		
20		56		56		
21		55		55		
22		56		55		flow change at Hatchery 0800
23		57		56		100 cfs
24		57		57		
25		57		57		
26		57	(1800)	56		flow change at HH 1240 hrs
27		58		57		75 cfs
28		58		58		
29		60		59		
30		60		60		
31		60	↓ 1090 hrs	60	↓ (1080 hrs)	flow change at HH 1715 hrs
	avg	57.4		56.8		
Sept. 1		62	(1800)	60	(1000-1100)	50 cfs
2		62		61		
3		61		60		
4		61		60		
5		64		62		
6		61	1800	60	1100-1200	chart 02962 installed 1130 hrs. H ₂ O SE of G-1
7		60		58		flow change at HH 1730
8		58		57		35 cfs
9		57		57		
10		57		57		
11		57		55		
12		56		55		

* Instrument # 8511 (w. chart 03349) installed 6-18-64; stolen.

Poogenut Valley - Utah

Sheet 6763

DATE		WATER TEMPERATURE			Remarks - Flow
		Max	(Time)	Min	
Sept	13	56		56	35 g
	14	56		56	↓
	15	56		55	
	16	55		55	
	17	62	(1600-1800)	55	7000
	18	60		60	
	19	60		59	
	20	59		59	
	21	58		58	
	22	58		57	
	23	57		57	
	24	57		57	
	25	57		57	
	26	57		57	
	27	58		58	
	28	58		58	
	29	58		58	
	30	58		58	1732 L. W.
	avg	58.5	1756 L. W.	57.7	
Oct	1	57		57	35 g
	2	57		57	↓
	3	58		57	
	4	56	1800 →	53	1100-1200
	5	57		56	
	6	57		57	
	7	57		57	
	8	57		57	
	9	57		57	
	10	57		57	
	11	57		57	
	12	57		57	
	13	57		57	
	14	57		57	
	15	57		57	

Poquonnet Valley - Water

Sheet 6763

WATER TEMPERATURE

DATE Read (Time) Min (Time) Flow-Remarks

Oct 16	57	0100-0600	55	1300 on	35 ft
17	57		55		Chart 03-40 installed on river
18	57	1400 on	56	1000-1200	100 ft 5 ft below surface
19	57		57		
20	57		57		
21	57		57		
22	57		56		
23	57		56		
24	57		57		
25	57		57		
26	57		57		
27	57		57		
28	57		57		
29	57		57		
30	57		57		
31	56	1764 ft	56	1754 ft	
avg.	57.0		56.6		

Nov 1	56		56		35 ft
2	56		56		↓
3	56		56		
4	56		56		
5	56		56		
6	55		55		
7	55		55		
8	55		55		
9	55		55		
10	55		55		
11	56		55		
12	56		56		
13	55		55		
14	54		53		
15	53		53		

Peopemant Valley - Utah

July 1963

WATER TEMPERATURE

DATE

Mid. (F)

Time (F)

Time (F)

Remarks

Nov 16

53

53

17

53

53

18

54

53

19

54

54

20

54

54

21

54

54

22

54

54

23

54

54

24

54

54

25

53

53

26

53

53

27

53

52

28

52

51

29

51

51

30

51

51

1626 total

1515 total

→ see 45 day record

avg.

54.2

50.5

Therm. removed 12-5-68
1030 hrs, 30 gfo, air 36°F
H₂O 46°F
Remain link chain (25") was
locked to base of 12" dia
incense cedar tree approx
180' from river campsite
at gorge. see picture.
chain locked with Master
lock 22 # 536.

Preston Meadows F-4 H-0

No. of days/month temperature occurred in each of range

Water Temperature	June 1-30 12 days	July 1-31 23 days	Aug 1-31 18 days	Sept. 1-30 22 days	Oct. 1-31 31 days	Nov. 1-30 30 days
	High Low	High Low	High Low	High Low	High Low	High Low
30-39°F	0 0	0 0	0 0	0 0	0 0	0 0
40-49	0 0	0 0	0 0	0 0	0 0	0 0
50-59	0 0	0 0	8 12	0 3	0 0	0 0
60-69	10 0	23 23	10 6	30 27	8 2	0 0
70-79	2 12	0 0	0 0	0 0	0 0	0 0
80-89	0 0	0 0	0 0	0 0	0 0	0 0
Above 90	0 0	0 0	0 0	0 0	0 0	0 0

Monthly average Temp °F	max.	min.
	67.9	65.9
	67.3	66.3
	60.0	59.1
	64.7	63.3
	57.2	56.4
	50.8	50.8

|| max. temp. recorded was 70°F

DAD

1-7-69

P.M. - 1968

Station 110000

T-4 H-0

Instrument # 9090

Chart 0350

WATER TEMP				WATER TEMP			
DATE	MAY	MIN	FLOOD	DATE	MAY	MIN	FLOOD
June 19	(1800) 67	(0900) 66		July 17	(1800) 67	(0900) 66	
20	" 68	" 66		18	" 67	" 66	
21	" 68	" 66		19	" 67	" 66	
22	" 68	" 66		20	" 67	" 66	
23	(0001) 68	(2140) 67		21	" 67	" 66	
24	(1800) 64	(0900) 62		22	" 67	" 66	
25	(1800) 66	(0300) 64		23	" 67	" 66	
26	(1800) 64	(0600) 68		24	" 67	" 66	
27	(1800) 70	(0900) 69		AVERAGE	67.3	66.3	
28	(0001) 70	(0900) 68					
29	(0800) 68	(0900) 68					
Ave. 67.9	30	" 67	" 66	Ave. 65.9			
July 1	" 66	" 65					
2	" 66	" 65					
3	" 67	" 65					
4	" 67	" 66					
5	" 68	" 67					
6	" 69	" 68					
7	" 69	" 68					
8	" 68	" 67					
9	" 67	" 66					
10	" 67	" 66					
11	" 68	" 67					
12	" 68	" 67					
13	" 68	" 67					
14	" 68	" 67					
15	" 67	" 67					
16	" 67	" 66					

* leaky thermograph; malfunctioning; no data

03087

chart # 0000
2nd. - 9090

STATION
T-4 Preston Meadows (H₂O)

DATE	Remarks	Temp. F° Max.	F° Time	Temp. F° Min.	F° Time	Flow
Aug. 13	150 cfs	—	—	—	—	8-11-68 2300 hrs (flow 150 cfs)
14	}	60	(1700-1900)	60	(0900-1000)	
15		60		59		
16		60		60		
17		125 cfs	59		59	
18	}	59		59		
19		59		58		
20		57		57		
21		57		57		
Sept. 22	100 cfs	56	(1700-1900)	55	(0900-1100)	Flow change HH to 100 cfs 8 AM
23	}	58		56		
24		60		58		
25		60		59		
26		59		58		Flow change HH 1840 hrs 75 cfs
27	75 cfs	60		59		
28	}	62		60		
29		63		62		
30		65	1020 hrs	63	1063 hrs	
31		66	(60.0)	64	(59.1)	Flow change 4# 1715 hrs 50 cfs
Sept 1	50 cfs	67		65		
2	}	67		65		
3		68		65		
4		67		65		Chart 0321 installed 1925 hrs H ₂ O temp 66°F
5		67		65		Flow change HH 1730 hrs 35 cfs
6		67		65		
7		67		65		
8		67		66		
9		67		66		
10		67		66		
11		67		66		
12		67		65		
13		67		65		
14		66		65		

T-4 ~~ARE~~ H₂O

9090

DATE	AIR TEMPERATURE		TIME		REMARKS - TIME
	MAX.	MIN.	TIME	TIME	
Sept 16	66	64	1800-2100	0900-1200	
17	66	64			
18	66	64			
19	65	65			
20	63	60			
21	63	62			
22	61	60			
23	60	59			
24	60	59			
25	61	59			
26	61	60			
27	61	60			
28	61	60			
29	61	60			
30	61	60	1940-1950	1818-1822	
	avg	64.7		63.3	
Oct 1	60	59			35 ya
2	61	59			
3	60	59			
4	61	59			
5	61	60			
6	61	60			
7	61	59			
8	60	59			
9	59	58			
10	59	57			
11	58	57			
12	57	57			
13	57	57			
14	57	56			
15	57	55			
16	55	54			
17	55	54			
18	55	54			

→ chart 03453 installed 1330 hrs
35 ofu, water 55°F bulb, air 57°F

T-4 H₂O

June 1970

WATER TEMPERATURE

DATE

MAX

TIME

MIN

TIME

Remarks - Flow

Oct 20	55	1500-2400	55	0700-1000	
21	55		55		
22	55		55		
23	55		55		
24	55		55		
25	55		55		
26	56		55		
27	56		55		
28	56		56		
29	56		56		
30	55		55		
31	55	11TB	55	1749	
	avg	57.2		56.4	

Nov 1	54		54		
2	54		54		
3	54		53		
4	53		53		
5	53		53		
6	53		53		
7	53		53		
8	53		52		
9	52		52		
10	53		52		
11	53		53		
12	53		53		
13	53		52		
14	52		51		
15	50		49		
16	49		48		
17	49		49		
18	49		49		
19	50		50		

4 H-20

June 1990

DATE	WATER TEMPERATURE		TIME		Remarks - Flow
	1524 Hrs	1511 Hrs	Min.	Sec.	
Nov 20	50	50	—	—	
21	50	50			
22	50	50			
23	50	50			
24	50	49			
25	49	49			
26	49	48			
27	48	47			
28	47	46			
29	46	45			
30	45	45			
	avg (50.8)	(50.4)			

end 45 day record.
 thermo removed 12-3-68
 1100 hrs. air 34°F; H₂O 43°F
 steel chain used to secure therm
 locked around 12" dia. live
 oak tree REB above 6'40"
 cfs hi-flow line about 30'
 in line with T-4 sta
 #5, locked with Master
 lock # E-504,

PRESTON

June 1968

TEMP STATION PRESTON

days/month TEMP. occurred in month

TEMP.	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Air - Air	max	min	max	min	max	min	max	min	max	min	max	min
MAY (1968)	0(0)	0	0	0(0)	0	0	0	0	0	0	1	9
30-39.9°	0(0)	0	0	0	1	1	0	2	0	8	13	18
40-49.9°	0(0)	0	0	0	1	1	0	2	0	8	13	18
50-59.9°	0(0)	0	0	0	1	1	0	9	3	13	14	2
60-69.9°	0(10)	0	2	4	2	15	2	18	6	10	1	0
70-79.9°	0(2)	0	10	7	1	4	9	1	12	10	0	0
80-89.9°	4(0)	11	0	8	1	0	16	0	0	0	0	0
90°F	8(0)	20	0	2	12	0	5	0	12	0	0	0

monthly	max	min										
AUG.												
Temp °F	98.5	66.7	89.1	68.3	81.9	60.5	82.4	60.2	69.4	51.2	49.1	46

P.M. air - 1968

STATION MEADOW (A)			STATION 3045		
DATE	TEMP. HOUR (TIME)		TEMP. HOUR (TIME)		
JUNE 19	88.5° F (1700)		77° (0800)		→ MEASURED AT 1015
JUNE 20	90° (1800)		67° (0530)		
JUNE 21	>90° 5 hrs (1100)		66° (0600)		
JUNE 22	>90° 9 hrs (1230)		66° (0500)		Average
JUNE 23	>90° 6 hrs (1400)		66° (0700)		maximum
JUNE 24	>90° 5 hrs (1300)		65.5° (0700)		air TEMP = 67.3
JUNE 25	>90° 5 hrs (1030)		67° (0700)		
JUNE 26	>90° 6 hrs (1100)		67° (0700)		
JUNE 27	>90° 6 hrs (1100)		70° (0700)		
JUNE 28	85° (1300)		64.5° (0700)		
JUNE 29	80.5° AVE (1500)		62.9° AVE (0700)		
JUNE 30	86° 88.5° (1600)		61° 66.7° (0700)		
JULY 1	>90° 2 hrs (1400)		67° (0600)		
JULY 2	87° (1600)		65° (0500)		
JULY 3	89° (1600)		63° (0600)		
JULY 4	>90° 5 hrs (1000)		66° (0600)		
JULY 5	>90° 9 hrs (0930)		68.5° (0500)		
JULY 6	>90° 7 hrs (1000)		71° (0600)		
JULY 7	90° (1400)		73° (0600)		
JULY 8	86° (1000)		73° (0600)		
JULY 9	88° (1600)		70° (0430)		
JULY 10	>90° 6 hrs (1030)		70° (0100)		
JULY 11	>90° 6 hrs (1000)		69° (0600)		
JULY 12	>90° 5 hrs (1300)		69° (0500)		
JULY 13	87° (1500)		66° (0500)		
JULY 14	85.5° (1100)		66° (0530)		
JULY 15	86° (1400)		66° (0500)		
JULY 16	86.5° (1400)		62.5° (0600)		
JULY 17	89.5° (1400)		62.5° (0500)		
JULY 18	>90° 6 hrs (0930)		65° (0530)		
JULY 19	>90° 7 hrs (0930)		68° (0400)		
JULY 20	>90° 7 hrs (0930)		70° (0500)		
JULY 21	>90° 6 hrs (1000)		67° (0530)		
JULY 22	>90° 6 hrs (0930)		68° (0100)		
JULY 23	>90° 5 hrs (0930)		67° (0500)		
JULY 24	>90° 5 hrs (1000)		67° (0600)		
JULY 25	(0900)		67° (0500)		
	↓ TEMP. WHEN REMOVED				

STATION T-4 Preston Meadows (AIR)

Chart # 93193
Date - 9/2/5

DATE	Remarks	Temp. F° MAX.	Time	Temp. F° MIN.	Time	Flow
July 25		> 90	(6300-1400)			
26		> 90		68	(0500-0800)	
27		> 90		69		
28		> 90		68		
29		> 90		70		
30		> 90		75		
31		88	(1100)	75		
		Ave. 89.1		Ave. 68.3		
Aug 1		> 90	(1300-1600)	69	(0500-0800)	
2		> 90		68		
3		> 90		68		
4		> 90		67		
5		> 90		69		
6		> 90		66		
7		> 90		68		
8		89		71		
9		> 90		70		
10		90		71		Flow change at Hatchery 8 AM → to 731
11		88		64		
12		85		66		150 cfs
13		68		64		
14		72		56		
15		76		58		
16		74		62		
17		75		58		Flow change at Hatchery 0800
18		72		58		125 cfs
19		65		64		
20		64		56		
21		61		50		
22		72		49		Flow change at HH 1800
23		80		54		100 cfs
24		85		59		
25		79		58		
26		82		58		Flow change at HH 1840
27		83		60		75 cfs

ACTION

T-4

Preston Meadows

(AIR)

Start 9/28/72

End 9/30/72

DATE	Remarks	Temp F° Max	Time	Temp F° Max	Time	Flow
Aug. 28		88	(1300-1600)	59	(0500-0800)	
29		>90		62		
30		>90		67		
31		>90		71		
		81.9		60.5		
1		>90		70	(0700-0900)	
2		86		69		
3	thin sp.	86		64		
4	10 hrs. slow	87		64		
5	check ↑	>90	(1400-1600)	64	(0600-0800)	chart removed
6		>90 →	avg. 6 hrs	65	Flow changed at 1130 hrs. 35 cfs	2010 hrs. 94 cfs
7		>90		66		9 cfs, air building
8		>90		66		73°F, H ₂ O 66°F
9		88		65		by M.F., COFG
10		84		63		chart 01754 inserted
11		84		62		
12		84		62		
13		83		63		
14		77		59		
15		78		58		
16		81		57		
17		85		60		
18		85		62		
19		74		60		
20		63		51		
21		66		48		
22		72		47		
23		79		50		
24		84		54		
25		86		58		
26		88		61		
27		87		62		
28		83		59		
29		75		62		
30		73		54		

STATION

T-4 Preston Meadow Air Instr. # 3045

AIR TEMPERATURE

DATE MAX. (TIME) MIN. (TIME) Remarks - Notes

Oct. 1	73	(1300-1600)	53	(0800-0800)	instr. approx. within 1 foot
2	77		53		
3	74		53		
4	73		56		
5	73		54		
6	71		53		instr. approx. within 1 foot
7					instr. approx. within 1 foot
8					
9					
10					
11					
12					
13					
14					
15					
16					chart removed Books, 10-16-68 in-
17	66	(1500-1600)	48	(0700-0900)	35 fps, air temp 87°F, clear day
18	64		48		chart 03009 inserted.
19	68		46		
20	67		51		
21	69		46		
22	67		46		
23	71		47		
24	77		54		
25	77		59		
26	74		53		
27	78		52		
28	75		59		
29	57		53		
30	53		46		
31	54		47		

69.4 avg

51.2 avg

2 days

STATION

T-4 PRESTON MEADOW - AIR T-4 - 1965

AIR TEMPERATURE

DATE

MAX. (TIME)

MIN. (TIME)

REMARKS - FEEL

Nov. 1

53

(1300-1500)

43

(0500-0700)

2

53

50

3

53

52

4

52

46

5

53

47

6

52

46

7

54

45

8

53

47

9

57

45

10

57

46

11

60

49

12

47

43

13

46

39

14

44

(1300-1400)

34

(0500-0700)

15

47

36

16

49

39

17

52

45

18

51

45

19

47

42

20

48

41

21

52

46

22

53

44

23

45

41

24

46

45

25

41

39

26

41

33

27

40

35

28

38

32

29

40

35

49.1 avg.42.1 avg.

end 45 day record.
 instr. approx. 1 ft. feet; more
 more accurately during cold weather
 than hot weather
 instr. removed 12-3-68 @ 1100
 35 ft; air temp 34°F @ 1100
 H₂O temp 43°F clear day.

Early Intake Grazing Station

No. of experiments completed
 recorded in each 25 range

Water Temperature

latitude	June 14-30 17 days	July 1-31 31 days	Aug 1-31 31 days	Sept 1-30 30 days	Oct 1-31 31 days	Nov 1-30 30 days
	H ₂ O	H ₂ O	H ₂ O	H ₂ O	H ₂ O	H ₂ O
	High Low	High Low	High Low	High Low	High Low	High Low
30-39	0 0	0 0	0 0	0 0	0 0	0 0
40-49	0 0	0 0	0 0	0 0	0 0	0 0
50-59	0 0	0 2	4 10	0 5	24 29	14 12
60-69	2 15	0 27	16 21	18 25	7 2	0 0
70-79	15 12	31 34	11 0	12 0	0 0	0 0
80-89	0 0	0 0	0 0	0 0	0 0	0 0
Above 90	0 0	0 0	0 0	0 0	0 0	0 0
Average	max	max				
Temp. (°F)	74 67	73.6 68.5	65.2 62.3	66.7 63.2	57.2 56.2	50.0 49

- 1) max. temp. recorded was 77°F
- 2) max. temp. recorded was 76°F
- 3) " " " " 73°F
- 4) " " " " 71°F

E.I. - 1968

Instrument # 8866

WATER TEMP

DATE MAX MIN FLOW

June 14	(1800) 71	(68)	
15	(1700) 75	(1000) 66	
16	(800) 76	(1900) 67	
17	(1800) 74	(1000) 68	
18	(1700) 71	(1000) 68	
19	(1500) 74	(1000) 68	
20	(1800) 76	(1000) 67	
21	(1800) 76	(1000) 67	
22	(1800) 71	(1000) 68	
23	(1700) 69	(2400) 69	
24	(1900) 69	(1000) 62	
25	(1900) 72	(1000) 66	
26	(1800) 75	(1000) 69	
27	(1800) 76	(1000) 71	
27	(1800) 75	(1000) 70	
28	" 73	" 68	

Ave 74° - 73 " 67

July 1	" 73	" 67	
2	" 72	" 67	
3	" 73	" 67	
4	" 74	" 68	
5	" 75	" 69	
6	" 76	" 70	
7	" 74	" 71	
8	" 73	" 70	
9	" 73	" 69	
10	" 74	" 68	
11	" 74	" 68	
12	" 74	" 69	
13	" 74	" 69	
14	" 74	" 69	
15	" 74	" 68	

WATER TEMP

DATE MAX MIN FLOW

July 16	(1800) 74	(1000) 68	
17	" 73	" 68	
18	" 74	" 68	
19	" 74	" 68	
20	" 74	" 68	
21	" 74	" 68	
22	" 74	" 68	
23	" 74	" 68	
24	" 74	" 68	

Average 73.8° 68°

This Thermograph was approx 7 mi east @ the end of 41 days.

TEMP. H₂O
MAX. MIN.

July 25	(1700) 76°	(1100) 68°
26	(2000) 74	(1100) 68°
27	(1200) 74	(1100) 69
28	(1500) 71	(1100) 70°
29	(1800) 73	(1000) 68°
30	(1700) 71	(1200) 69
31	(2000) 70	(1200) 69°

Average 73.6 68.5

tion EARLY INTAKE (H₂O)

DATE 8/31/66
INT. - 8866

DATE		REMARKS	TEMP (F) MAX.	TEMP (F) TIME	TEMP (F) MIN.	TEMP (F) TIME	Flow
Aug	1		72	(1900)	68	(0900-1100)	
	2		72	(2000)	68		
	3		73	(2000)	68		
	4		73	(1900)	68		
	5		72	(2000)	68		
	6		72	(2000)	68		
	7		72	(2000)	68		
	8		72	(2100)	68		
	9		71	(2100)	68		
	10	Flow change all weekend	71	(2000)	68		
e flow	(11)		(61)	(2000)	(57)		Aug 11 0800 - 4000 to 7300
	12	Start Flow Study	(61)	(1900)	(58)		
	13		62	(1900)	61		
	14		62	(2000)	60		Aug 11 2300 - 1500 cfs
	15		62	(1900)	60		
	16		62	(1800)	60		
	17	Flow change at Hatchery	62	(1800)	60		time flows arrive to affect temp.
	18		60	(1800)	59		
	19		59	(1900-2000)	59		125 cfs
	20		58		58		
	21		56		56		
	22	Flow change at Hatchery	58		55		
	23		60		56		
	24		62		59		100 cfs
	25		62		60		
	26	Flow change at Hatchery PM	63		59		
	27		63		60		
	28		65		61		
	29		67		63		75 cfs
	30		68		65		
	31	Flow change at Hatchery PM	70	avg (65.2)	66	avg (62.3)	AVG.
Sept.	1		70	(1900-2000)	67		
	2		70		67		
	3		70		67		
	4		70		67		
	5	Flow change at Hatchery PM	70		67		
	6	air changed 1030 Pm	70		67		Thermograph 500' app. x. 7 hrs. part.

H₂O temp

Early

Intake

Gauging Station

Inch # 8766

DATE

Remarks

WATER
TEMPERATURE

MAX.

Time

MIN.

Time

Flow

Sept. 7

chart changed
Sept 6

71

(1200-1800)

67

(1200-1800)

35 cfs

8

71

67

9

71

67

10

70

67

11

Bell arrived
on PM. writing

70

67

12

70

66

13

Preston 1700
Camp break up

69

66

14

68

66

15

68

66

16

last day of
fish study

68

65

17

68

65

18

hatchery camp
break up

68

65

19

66

65

20

64

62

21

62

60

22

61

58

23

62

58

24

62

59

25

62

59

26

63

60

27

63

60

28

63

60

29

61

60

30

61

2002 total

59

1916 total

Avg.

66.763.8

Oct. 1

61

59

2

61

59

3

61

59

4

62

60

5

62

59

6

61

60

7

60

59

H₂O temp.

Early Intake Pumping Station

Chart # 8566

WATER

DATE

Remarks

TEMPERATURE

MAX.

TIME

MIN.

TIME

FLOW

Oct.	8	instr 4-6hr boat	59	(2000-2100)	57	(2000-2100)	35 cfs	
	9		58		57			
	10		58		57			
	11		57		57			
	12		57		57			
	13		57		57			
	14		56		56			
	15		55		54			
	16	chart changed	55		53		35 cfs	clean sk
	17	at 1900 hrs	56	(1900-2000)	55	(1000-1100)		
	18	H ₂ O temp bulb 56°F	56		55			
	19	chart #	56		55			
	20	02353	56		55			
	21	high wind no wind	55		54			
	22		55		54			
	23		55		54			
	24		56		55			
	25		56		55			
	26		56		55			
	27		56		55			
	28		56		56			
	29		55		55			
	30		55		55			
	31		55	1774 total	54	1742 total		
		AVG.	<u>57.2</u>		<u>56.2</u>			
Nov.	1		54	(1900-200)	53	(1000-1100)		
	2		54		54			
	3		54		54			
	4		53		53			
	5		54		52			
	6		52		52			
	7		52		51			
	8		52		51			

H₂O Temp.

Early Intake Gauging Station
Intake Pipe

DATE	Remarks	WATER TEMPERATURE				FLOW
		MAX.	Time	Min.	Time	
Nov. 9		52	(1100-2000)	51	(1000-1100)	35 cfs
10		52		51		
11		52		52		
12		52		51		
13		52		49		
14		49		48		
15		49		48		
16		49		48		
17		49		49		
18		50		49		
19		49		48		
20		48		48		
21		48		48		
22		49		48		
23		49		48		
24		49		48		
25		48		46		
26		46		45		
27		45		44		
28		44		44		
29	end 45-days	44	1450 total	44	1427 total	
30	Chart removed 12-3-68 H ₂ O temp 42°F @ 1500 hrs Clear day Air temp 40°F 24°	50.0 AVG.		49.2		

water year October 1, 1949 to September 30, 1950

[illegible]

U. S. Department of the Interior - Geological Survey - Water Resources Division

Temperature (°C) of water, *Tuplume above Early Intake* water year October 1, 1969 to September 30, 1970

ay	October		November		December		January		February		March		April		May		June		July		August		September	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
													13	7	15	10	12	9	15	13	19	15	23	19
													13	8	16	11	12	10	15	13	(	(	23	19
													13	8	16	12	12	9	16	14	(	(	23	18
													13	8	16	9	12	9	21	16	(	(	21	18
											9	6	14	9	12	9	12	9	23	19	19	15	21	17
											12	8	15	9	10	8	12	9	24	19	19	15	21	17
											11	9	15	9	12	8	12	10	14	12	20	15	22	18
											12	5	14	9	10	9	10	10	15	12	20	16	23	18
											10	9	13	10	12	9	10	10	14	13	20	16		
											11	9	14	9	11	8	11	10	15	13	20	15		
											12	9	11	7	10	9	12	9	15	13	20	16		
											12	10	10	8	11	9	11	9	16	14	21	17		
											12	10	10	8			11	9	18	15	21	17		
											14	8	9	5			11	10	17	15	21	17		
											15	10	7	6			13	10	18	14	20	16		
											15	12	9	8			14	11	18	15	20	17		
											15	12	9	8			14	12	18	15	21	17		
											14	13	9	8			14	12	18	15	21	18		
											14	12	10	8			14	12	14	16	21	18		
											11	11	9	8			13	10	14	16	21	18		
											14	11	10	7			12	11	19	16	21	18		
											15	11	9	7			12	10	19	16	21	17		
											16	13	13	8			13	11	19	16	21	17		
											19	15	13	8			13	12	19	16	21	18		
											14	10	15	10			12	11	(	(	21	18		
											15	10	14	9			12	12	(	(	21	17		
											15	11	11	9			15	13	(	(	21	18		
											15	10	11	9			15	13	(	(	22	18		
											14	9	13	8	12	9	14	13	(	(	23	19		
											12	9	14	9			15	13	19	16	23	19		
											12	8	15 10				19	15	23	19				

U. S. Department of the Interior - Geological Survey - Water Resources Division

Temperature (°C) of water *Fullage River above Early Intake* water year October 1968 September 30 1969

Day	October		November		December		January		February		March		April		May		June		July		August		September	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	18.2	4.1	16.6																					
2	18.2	4.1	16.6																					
3	17.8	4.1	16.6																					
4	17.8	4.1	16.6																					
5	17.8	4.1	16.6																					
6	17.8	4.1	16.6																					
7	17.8	4.1	16.6																					
8	17.8	4.1	16.6																					
9	17.8	4.1	16.6																					
10	17.8	4.1	16.6																					
11	17.8	4.1	16.6																					
12	17.8	4.1	16.6																					
13	17.8	4.1	16.6																					
14	17.8	4.1	16.6																					
15	17.8	4.1	16.6																					
16	17.8	4.1	16.6																					
17	17.8	4.1	16.6																					
18	17.8	4.1	16.6																					
19	17.8	4.1	16.6																					
20	17.8	4.1	16.6																					
21	17.8	4.1	16.6																					
22	17.8	4.1	16.6																					
23	17.8	4.1	16.6																					
24	17.8	4.1	16.6																					
25	17.8	4.1	16.6																					
26	17.8	4.1	16.6																					
27	17.8	4.1	16.6																					
28	17.8	4.1	16.6																					
29	17.8	4.1	16.6																					
30	17.8	4.1	16.6																					
31	17.8	4.1	16.6																					

Avg Range

July

August

	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Max	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104
Min	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80	

Max	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58
Min	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52

Temp.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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Min	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60

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Min	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69	69

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Thermos
Pulled due
Start flow
Overcast and in
100 CFS

Aug 1st

September

21 22 23 24 25 26 27 28 29 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

Max 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
Min 51.5 52.5 53.5 54.5 55.5 56.5 57.5 58.5 59.5 60.5 61.5 62.5 63.5 64.5 65.5 66.5 67.5 68.5 69.5 70.5 71.5 72.5 73.5 74.5 75.5 76.5 77.5 78.5 79.5 80.5 81.5 82.5 83.5 84.5 85.5 86.5 87.5 88.5 89.5 90.5 91.5 92.5 93.5 94.5 95.5 96.5 97.5 98.5 99.5 100.5

Max 87 88 89 90 91 92 93 94 95 96 97 98 99 100
Min 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Max 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
Min 51.5 52.5 53.5 54.5 55.5 56.5 57.5 58.5 59.5 60.5 61.5 62.5 63.5 64.5 65.5 66.5 67.5 68.5 69.5 70.5 71.5 72.5 73.5 74.5 75.5 76.5 77.5 78.5 79.5 80.5 81.5 82.5 83.5 84.5 85.5 86.5 87.5 88.5 89.5 90.5 91.5 92.5 93.5 94.5 95.5 96.5 97.5 98.5 99.5 100.5

Max 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
Min 51.5 52.5 53.5 54.5 55.5 56.5 57.5 58.5 59.5 60.5 61.5 62.5 63.5 64.5 65.5 66.5 67.5 68.5 69.5 70.5 71.5 72.5 73.5 74.5 75.5 76.5 77.5 78.5 79.5 80.5 81.5 82.5 83.5 84.5 85.5 86.5 87.5 88.5 89.5 90.5 91.5 92.5 93.5 94.5 95.5 96.5 97.5 98.5 99.5 100.5

100 CFS 75 CFS 75 CFS

SUBJECT H₂O Temp (565B)		DATE 8/18/70	PAGE OF 1 PAGES
SOURCE OF DATA 6750 inst No.			
OBTAINED BY WY		CHECKED BY	SECTION 7-1

Date	Water Temp (High)								
8/13/70	54								
8/14/70	54								
8/15/70	54								
8/16/70	54								
8/17/70	54								
8/18/70	54								
8/19/70	54								
8/20/70	54								
8/21/70	54								
8/22/70	54								
8/23/70	55								
8/24/70	55								
8/25/70	56								
8/26/70	56								
8/27/70	55								
8/28/70	55								
8/29/70	55								
8/30/70	55								
8/31/70	55								
9/1/70	55								
9/2/70	55								
9/3/70	54								
9/4/70	54								
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9/6/70	54								
9/7/70	54								
9/8/70	54								
9/9/70	54								
9/10/70	54								
9/11/70	54								
9/12/70	54								
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9/16/70	54								
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10/27/70	54								
10/28/70	54								
10/29/70	54								
10/30/70	54								
10/31/70	54								

PAGE 2 OF 2 PAGES

SOURCE OF DATA

90 90

Int No

COMPUTED BY

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DISCUSSION

7

[illegible]

H₂O Temp (5743)

DATE 4/11/70

PAGE 1 OF 2

SOURCE OF DATA

9254 Inlet No

REPORTED BY

1151

CHECKED BY

SECTION

6.4. Inlet

DATE	WATER TEMP (HIGH)								
4/29/70	58								
4/30/70	52								
5/1/70	56								
5/2/70	58								
5/3/70	58								
5/4/70	58								
5/5/70	51								
5/6/70	50								
5/7/70	50								
5/8/70	49								
5/9/70	51								
5/10/70	51								
5/11/70	52								
5/12/70	50								
5/13/70	51								
5/14/70	53								
5/15/70	51								
5/16/70	51								
5/17/70	51								
5/18/70	(56) -	inlet temp							
5/19/70	51								
5/20/70	51								
5/21/70	51								
5/22/70	51								
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5/24/70	52								
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6/27/70									
6/28/70									
6/29/70									
6/30/70									

* time required for slow to travel

1968
H₂O temp @ 90°F air temp

Tennessee River 15-2
OSD - EI

~~H₂O~~
T-1
Air 0
> 90

~~PM air~~
PM air
> 90°

T-1
H₂O

PV
H₂O

T-4
H₂O

EI
H₂O

Date
June 21
22
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July

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Aug

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Sept
Oct

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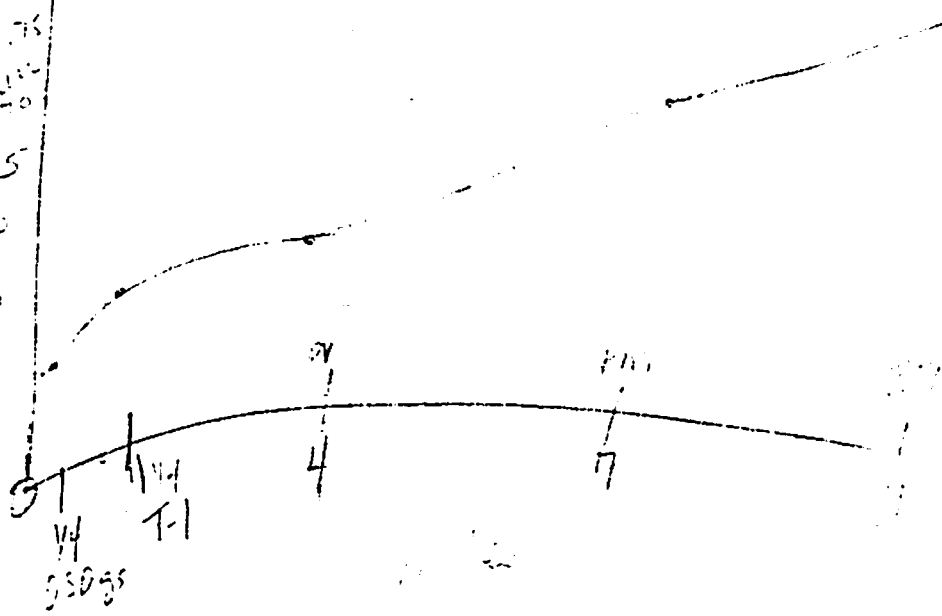
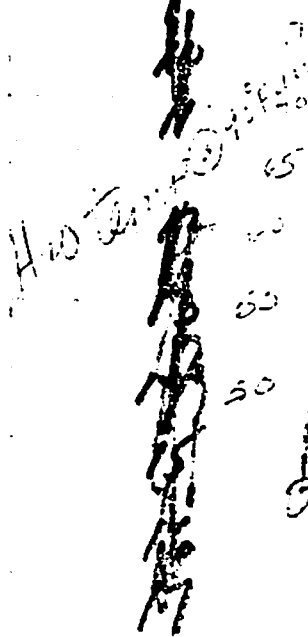
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354



Tuolumne River Fish Study - 1968
H2O Temp 68.0-84.9°F Air Temp - 65.0-81.0°F

Date	Air Temp		Water Temperature		ET	
	T-1	PM	OSD	T-1	PV	PM
June 13	85					
14	82					
15	86					
17	86					
18	89					
19	87	88	50	54	—	67 74
20	87					
23	87					
28	84	88	50	53	—	70 75
30	82	86	↓	52	—	67 73
July 2	85	87	50	54		66 72
3	87	89	↓			67 73
8	84	86	↓	54		68 73
9	84	88	↓	55		67 73
13	84	87	↓			67 74
14	83	85	↓	54		67 74
15	82	86	↓			68 ↓
16	84	86	51	55		— 73
17	88	89	↓			— 70
31	85	88	52	↓		— 72
Aug 8	88	89	51	56		— 72
11	85	88	↓	—	57	60 hi flow 61
12	83	85	↓	—	58	60 61
23	85	88	↓			
24	83	85	↓	54	57	60 62
27	83	83	52	53	58	60 63
28	88	88	↓	55	58	62 65
3	87	86	52			68 70
9	87	88	↓	56	57	64 71
10	86	84	↓	55	57	64 70
11	85	84	↓			6 70
12	85	88	51	↓	56	67 69
13	85	88	↓			60 68
17	87	88	↓		62	66
18	86	85	↓			

Water Temperatures

Note 15-5 Add 0.7°
to this
thermometer
reading

at

	<u>City</u>	<u>Gage</u> <u>Time</u>	<u>below</u> <u>Temp</u>	<u>H H</u>	<u>Time</u>	<u>Temp.</u>
July	16			August 21	8:55 AM	50°
	17			" 22	8:00 AM	51°
	18			" 23	8:10 AM	51°
	19	8:55 A.M.	51°	" 24	8:10 AM	50°
	20	8:20 A.M.	51°	" 25	8:15 AM	50°
	21	8:10 A.M.	50°	" 26	8:00 AM	50°
	22	8:07 AM	50°	" 27	8:10 AM	51°
	23	8:10 AM	50°	" 28	"	51°
	24	8:00 AM	51°	" 29	8:15 AM	52°
	25	8:05 AM	51°	" 30	8:00 AM	52°
	26	7:25 A.M.	51°	" 31	7:50 AM	52°
	27	8:00 AM	51°	Sept 1	8:00 AM	50°
	28	8:10 AM	52°	" 2	8:00 AM	51°
	29	8:20 AM	52°	" 3	10:10 AM	52°
	30	8:10 AM	52°	" 4	8:20 AM	53°
	31	7:45 AM	52°	" 5	8:00 AM	51°
August	1	7:45 AM	51°	" 6	8:00 AM	52°
"	2	8:00 AM	51°	" 7	8:10 AM	52°
	3	8:20 AM	51°	" 8	8:10 AM	52°
	4	8:15 AM	51°	" 9	"	52°
	5	8:05 AM	51°	" 10	"	52°
	6	6:40 AM	51°	" 11	"	52°
	7	8:20 AM	51°	" 12	"	52°
	8	"	51°	" 13	"	52°
	9	"	51°	" 14	"	52°
	10	"	51°	" 15	"	52°
	11	"	51°	" 16	"	51°
	12	8:15 AM	51°	" 17	9:30 AM	52°
	13	8:10 AM	52°	" 18	8:00 AM	51°
	14	8:10 AM	52°	" 19	"	52°
	15	7:40 AM	50°	" 20	"	51°
	16	8:00 AM	51°	" 21	"	50°
	17	8:00 AM	50°	" 22	"	50°
	18	7:45 AM	50°	" 23	"	50°
	19	8:15 AM	52°	" 24	9:30 AM	50°
	20	8:10 AM	51°	" 25	8:00 AM	51°

recording
 by Joe Brunette
 CSE - 11-1-54
 Williams

June July August Sept

Treutmann River Trucking Study, Hatch-Helley Dam - summary
of water temperature data - 1968.

Table for each area
Turb Rx above HH (H₂O)

84

- 1) Turb Rx (air + water)
- 2) T-1 (H₂O)
- 3) Deep Valley (H₂O)
- 4) Briston (air + H₂O)
- 5) Early Intake (H₂O)

Temp Station	Temp Station
(Type of above station)	
Temperature - Treutmann River above Hatch-Helley	
# days/month Temperature occurred in each group	
Temp Station	June July Aug
Air (H ₂ O)	
30-39.9°F	0 (0)
40-49.9	0 (0)
50-59.9	0 (0)
60-69.9	2 (6)
70-79.9	9 (3)
80-89.9	10 (5)
90-99.9	10 (0)
90°F	

Aug 13 T-1 H₂O thermo re-installed
0900 H₂O temp 58°F

150 cfs

Note: T-1 thermo jerked from
river Fri site 8-8-68

Aug 12 Poop Valley H₂O thermo 58°F H₂O

1430 hrs installed

inst # 6763

Sept 4 Changed T-Ra H₂O thermos H₂O

1115 hrs 28 cfs H₂O 65°F

Sept 4 T-1 thermo H₂O changed 50 cfs
1630 hrs 55°F

T-1 air thermo air temp bulb 91°F
inst # 8841 50 cfs

Sept 4 - evening hrs 6 PM? Changed by CDFG
Proctor T-meters air & water

Sept 5 1030 hrs Early Intake H₂O # 8866
67°F bulb H₂O

75 cfs to Aug
Aug 11 0800 - 11:00
Aug 12
Aug 1

75 cfs to
Aug 10 0800 400 cfs
to 730 cfs
to
Aug 11 11 PM then 150 cfs

Tuolumne River Study
1970
Thermograph Data

Location	Inst. No.	Temp. Range	Chart No.	Date Installed	Date Removed
Above H-H water	14097 DFG	30-90°F	given to B.I. Dahl	?	7-2-70
	14097 DFG	30-90°F	5682	7-2-70	8-7-70
T-1+2 Air	? BFW	?	5752	5-27-70	7-15-70
				7-15-70	
T-1+2 Water	6754 BFW	?	5633	4-28-70	7-15-70
	6754 BFW	?	?	7-15-70	
T-4 under	9090	?	5657	5-27-70	7-18-70
	9090	?	5691	7-18-70	
EI gage Air	8281	?	5924	5-27-70	7-16-70
	8281	?	5916	7-16-70	
EI gage water	9254	?	5680	5-27-70	7-16-70
		?	5729	7-16-70	

Below
Hetch Hetchy

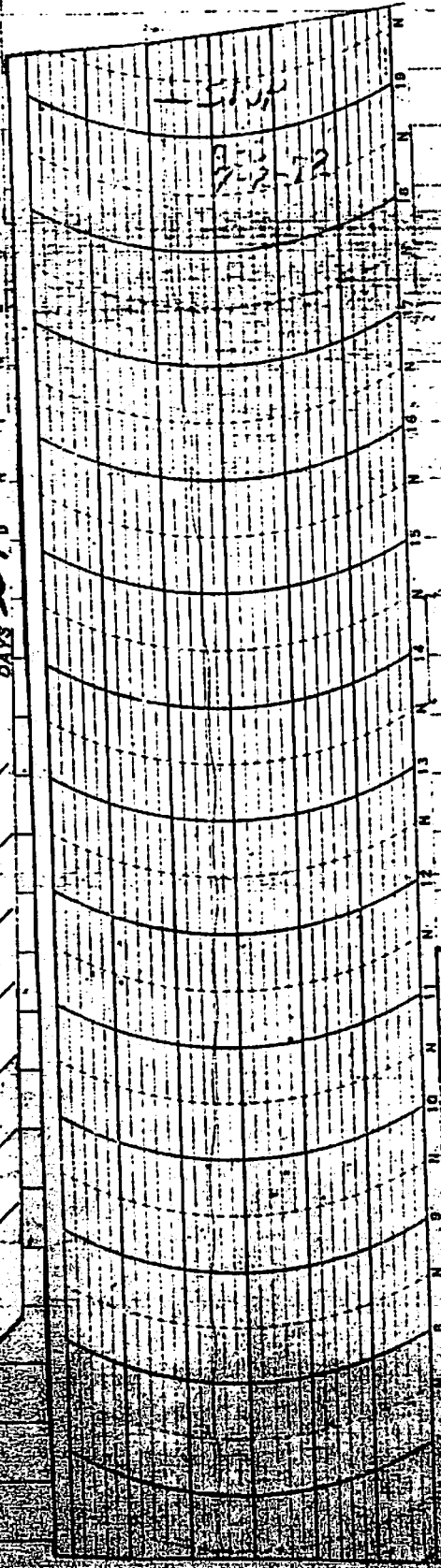
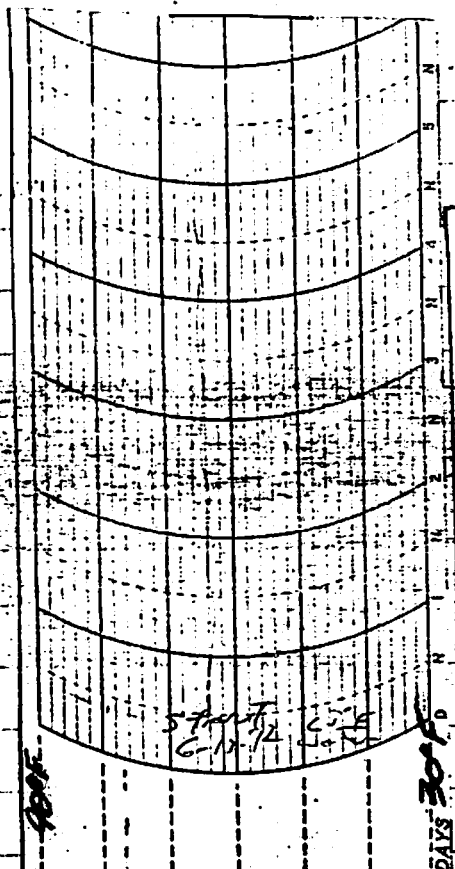
Water temp readings taken at about 8:00 AM

Feb 70	Oct 59	Nov	Dec	Jan
1-9°	12	11	11°	
2-9°	12			10°
3-9	12			8°
4-9	12			8°
5-9	12			8°
6-9	10			8°
7-9	11	No R		9°
8-9		11°		9°
9-9				10°
10-9				8°
11-9				
12-11°		11°		
13-9				
14-9				
15-9		12°	15°	9°
16-8			No R	9°
17-6°			8°?	
18-6			11°	
19-6				
20-6		11°		
21-7				
22-7				
23-11°				
24-7				
25-7				
26-7				
27-7	11	No R		
28-7	NR	11°		
29	NR			
30	NR			
31	11			

WEATHER AT EARLY INTAKE

FOR 24 HOUR PERIOD ENDING 0800 ON:

	<u>Maximum</u>	<u>Minimum</u>
8/1/71	99	67
8/2/71	101	64
8/3/71	102	65
8/4/71	99	64
8/5/71	97	63
8/6/71	97	62
8/7/71	97	60
8/8/71	96	61
8/9/71	99	62
8/10/71	103	64
8/11/71	106	65
8/12/71	103	70
8/13/71	100	63
8/14/71	98	61
8/15/71	98	60
8/16/71	97	60
8/17/71	97	59
8/18/71	97	59
8/19/71	96	59
8/20/71	95	56
8/21/71	91	55
8/22/71	91	53
8/23/71	90	56
8/24/71	94	59



40°F

DAYS 30°F

HI — CALIBRATED TEMP. SCALE — LO

°F

RYAN INSTRUMENTS, INC.
SEATTLE, WASH.
QUART. REG. 61072

INSTR. NO.

DATA

6-13-72
Water Temp 60°F
Wilmington client
NOT JIPFW
RUSSES

1500

7-2-72

DATA: 18-72
INSTR. NO. 7430
Flood Meadows
7-18-72
7-18-72

CALIBRATED
TEMP. SCALE

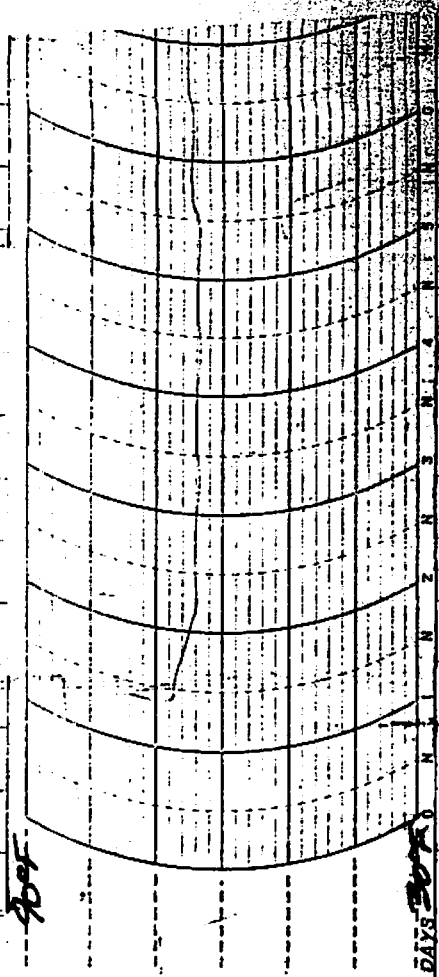
HI 7.0
7.0

5.5

7-13

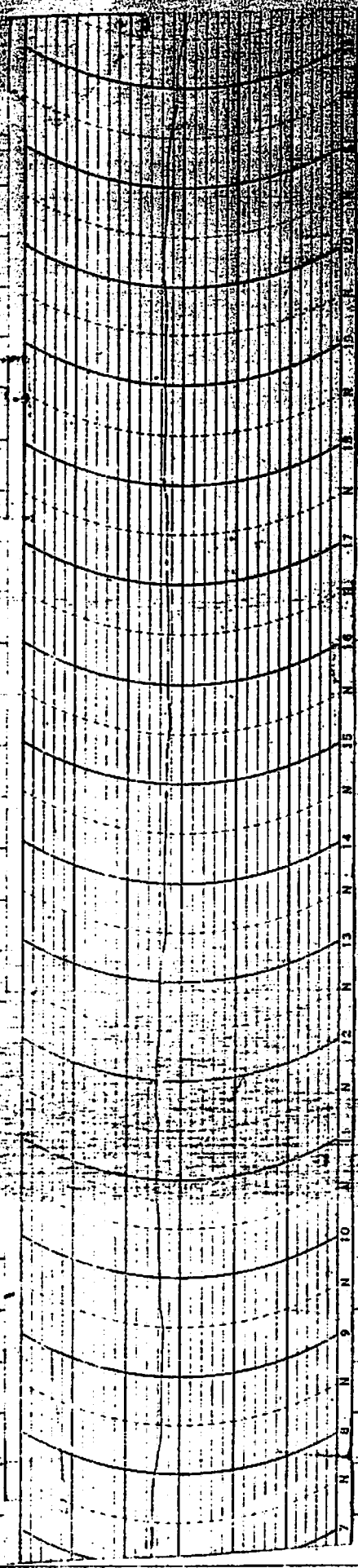
7-13

174



HI 30 CALIBRATED TEMP. SCALE 30
LO

MANUFACTURED BY, INC.
STATE, WASH.
(each set, \$10.00)
INSTR. NO. 7930
DATE: 8-22-72 10:30 AM
BSF 35
Preston Mints
EPA



17-5

Preston Indus.
8-22-72 → 9-29-72 cont.

