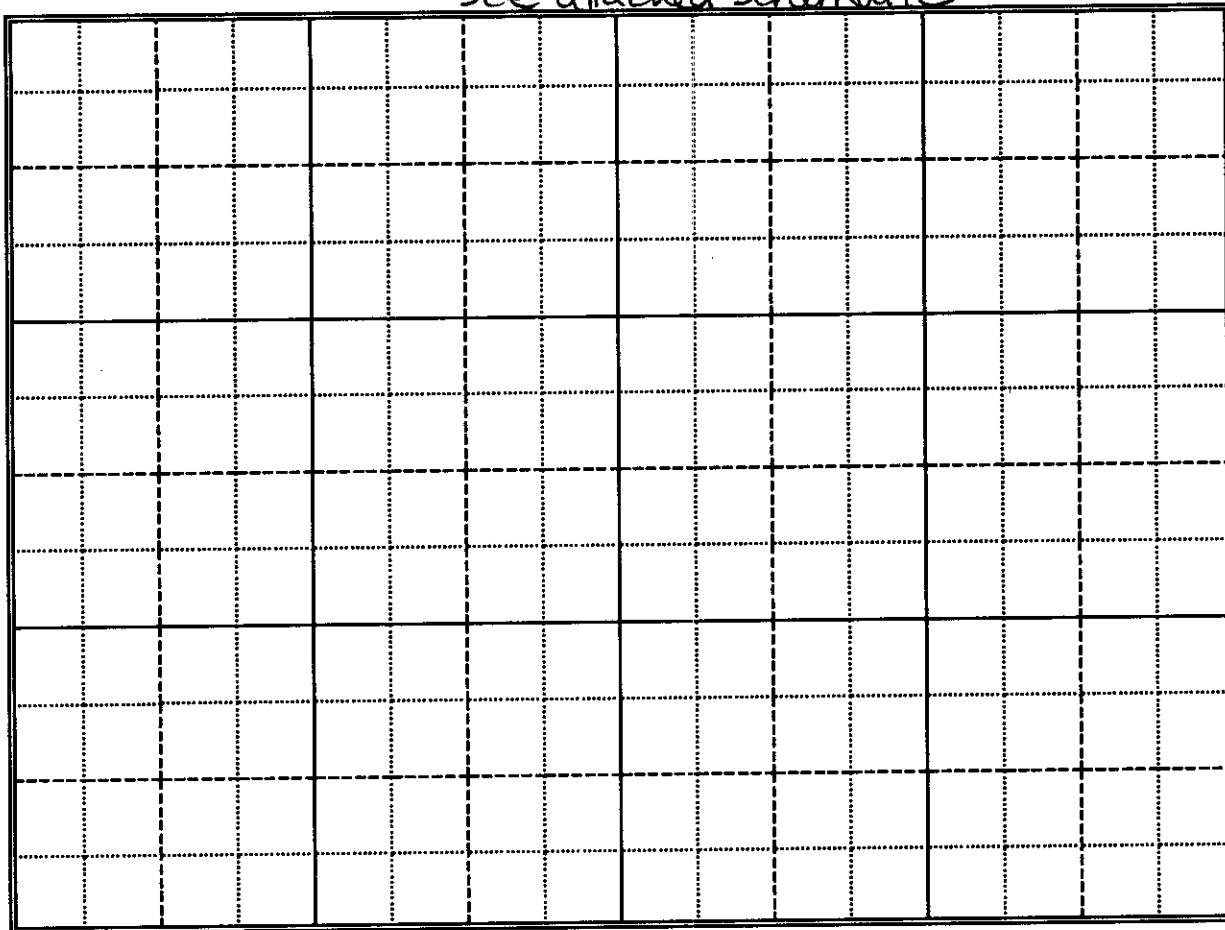


[illegible]

3. **Delivery System Diagram:** Indicate all major components and distances between components. Indicate weir size/ditch size/pipe I.d. as applicable.

See attached Schematic



Scale: 1" = _____

 Copy of USGS Quadrangle Attached Showing location(s) of point(s) of diversion and place(s) of use (required).

 Aerial Photo Attached (required for irrigation of 10+ acres)

 Photo of Diversion and System Attached

4. *N/A*

Well or Diversion Identification No.*	Motor Make	Hp	Motor Serial No.	Pump Make	Pump Serial No. or Discharge Size

*Code to correspond with No. on map and aerial photo

D. FLOW MEASUREMENTS

1. *See certificates of calibration contained in performance data*

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calib. Date
<i>Pressure gage</i>	<i>etc.</i>					

2. Measurements: *None. See attached performance data. Day of exam, plant was generating ~40 kW = ~1 cfs*

E. NARRATIVE/REMARKS/COMMENTS

Permit developed for hydropower production.

A concrete collection Structure sits beside & adjacent to John Day Creek. Nearly 100% of channel is directed into the Structure and through over 13,000 ft of 18" penstock to the powerhouse. The plant is rated at a maximum production of 451 kW at 16.9 cfs.

At the powerhouse, flows fall into a ^(concrete) tailrace, then return to John Day Creek. (Irrigation flow for Mr. Cereghino's ranch is withdrawn ~~also~~ at the tailrace Structure). Flow & energy generation are continuously monitored at the control center (see photo). In addition, a separate system monitors minimum flows in the dewatered channel between the P/D & the tailrace. FERC mediation req's 4.5 cfs winter & 12.0 cfs summer flows in channel. A screwgate in concrete P/D Structure releases flows to regulate minimum supply. Hydraulic gate regulates flows to penstock.

- * Attached Evaluation of Performance test data documents penstock capacity at 22.6 cfs. However, penstock design problems resulted in pressure drops at high-end flows, with subsequent reductions in kW generation. Maximum efficiency realized at ~~16.9~~ cfs. Flows ~~above~~ ^{exceeding} this are not beneficially used and therefore are not recommended. Please address this issue via license condition.

SCA permit #79-S-77

Have conditions of permit approval been met? ☒ yes ☐ no

F. FLOW CALCULATIONS

Measured Method:

Additional Computation Sheets Attached
See performance data evaluation

System capacity = 22.6 cfs

Amount beneficially used = 16.9 cfs

G. VOLUME CALCULATIONS

1. Volume Calculations for Irrigation:

$V_{I.R.} = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) = \underline{N/A}$

$V_{D.R.} = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation Season}) \times 1.9835 = \underline{\hspace{2cm}}$

$V = \text{Smaller of } V_{I.R.} \text{ and } V_{D.R.} = \underline{\hspace{2cm}}$

2. Volume Calculations for Other Uses: ~~Power~~

POWER $16.9 \times 365 \times 1.9835 = 12,235 \text{ AFA}$

NO CONSUMPTIVE USE

H. RECOMMENDATIONS

1. Recommended Amounts

Beneficial Use	Period of Use		Rate of Diversion Q (cfs)	Annual Volume V (afa)
	From	To		
POWER	1/1	12/31	16.9	
Totals:			16.9	

2. Recommended Amendments

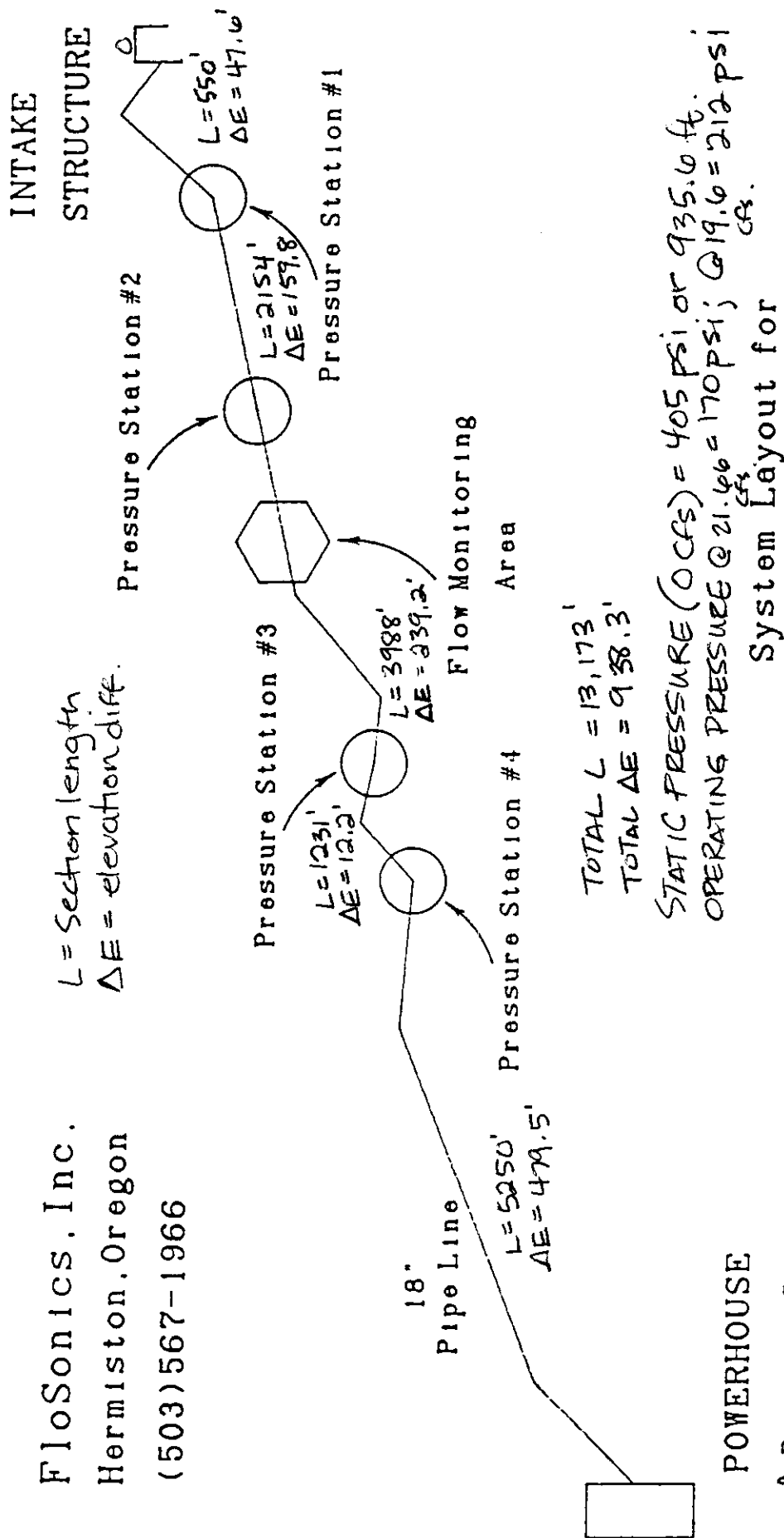
☐ Change P.D. as reflected above ☐ Add P.D. as reflected above ☐ None
☒ Change P.U. as reflected above ☐ Add P.U. as reflected above ☐ Other

I. AUTHENTICATION

Field Examiner's Name Cindy J. Hodges Date 12/20/93

Reviewer _____ Date _____

SEAL



FloSonics, Inc.
Hermiston, Oregon
(503) 567-1966

TOTAL L = 13,173'
TOTAL ΔE = 938.3'

STATIC PRESSURE (0 cfs) = 405 psi or 935.6 ft.
OPERATING PRESSURE @ 21.66 cfs = 170 psi; @ 19.6 cfs = 212 psi

System Layout for

JOHN DAY CREEK HYDRO PROJECT

LUCILE, IDAHO

Dave Cereghino

(no scale)

Pipeflow Computation Spreadsheet (DRT 12/31/1992)

Data Entered By: Cindy Hodges

Project: Flow Computation for Permit No. 79-7089
Cereghino

Given: See Data Table

Compute head losses with the Williams and Hazen Formula:

$$f = 0.2083 * (100 / \text{roughness})^{1.85} * ((\text{cfs} * 448.8)^{1.852} / \text{ID}^{4.8655} * \text{Length} / 100)$$

To Find: Compute the Rate of Flow

Data Table

Total Head: 938.30 feet

Pressure Req'd: 170.00 psi

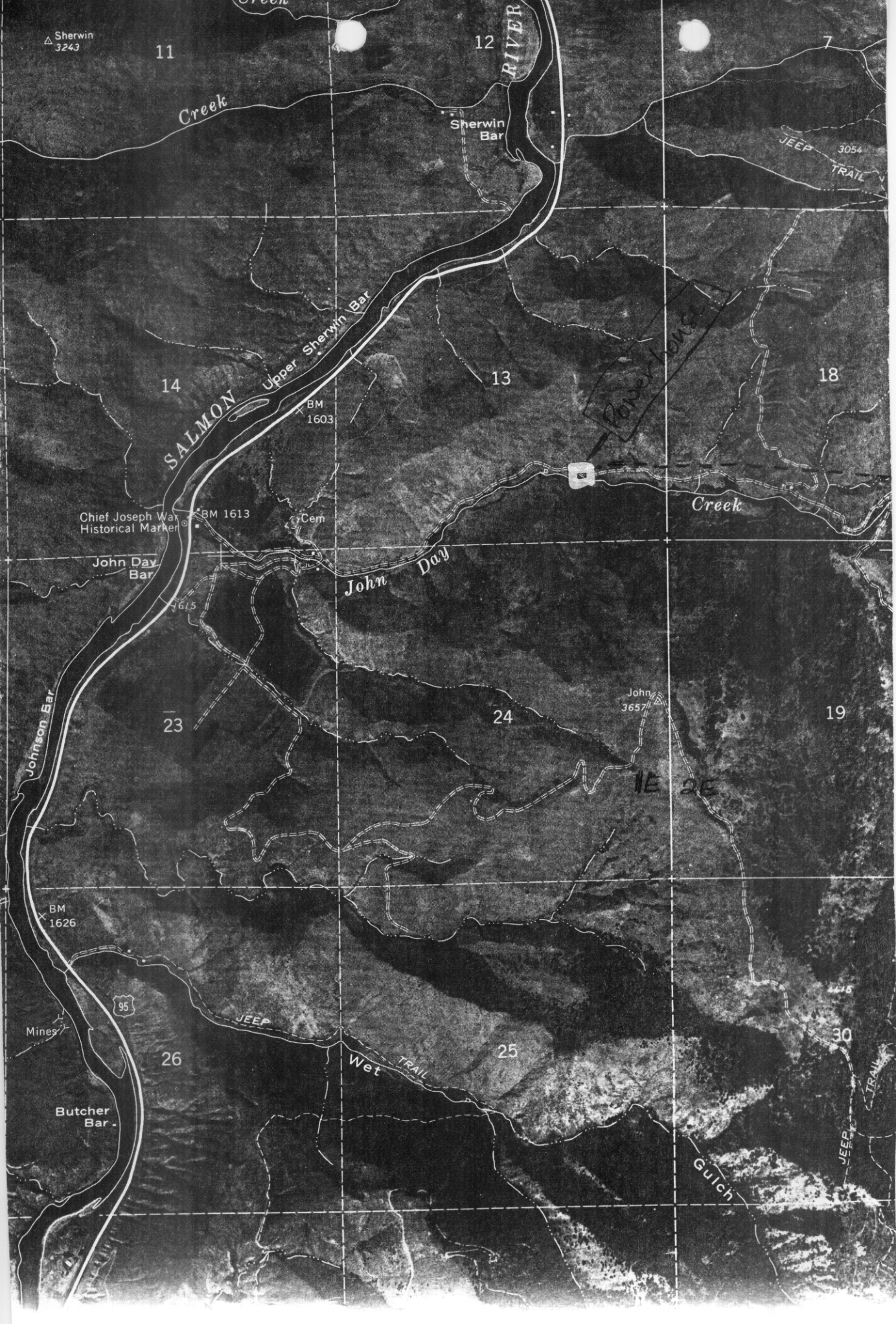
Available Head: 545.60 feet

Pipe Roughness: 104.00 Note: pvc = 150, smooth and straight pipe = 140
aluminum - joint length 20' = 125, joint length
30' = 130, joint length 40' = 132, joint length
50' = 134, new riveted steel = 100
old riveted steel = 100, old cast iron = 95,
old pipes in poor condition = 60 to 80

Inside Diameter in Inches	Equivalent Length in Feet	Unit Head Loss	Total Head Loss from Pipe Friction
17.75	13173.00	545.54	
3.80	0.00	0.00	
1.90	0.00	0.00	
			545.54

Rate of Flow: 22.280 CFS

JOHN DAY CREEK HYDRO PROJECT												
LUCILE, IDAHO												
DAVE GREGGINS												
Hf = FRICTION LOSS IN SECTION IN (FT)												
"C" = HAZEN-WILLIAMS CALCULATED ROUGHNESS COEFFICIENT												
P' = PRESSURE DIFFERENCE IN SECTION IN (PSI)												
H' = PRESSURE DIFFERENCE IN SECTION IN (FT)												
STATION LENGTH = 550 FT.												
ELEVATION DIFFERENCE = 47.4 FT.												
STATION LENGTH = 2154 FT.												
ELEVATION DIFFERENCE = 153.6 FT.												
STATION LENGTH = 3988 FT.												
ELEVATION DIFFERENCE = 231.0 FT.												
STATION LENGTH = 1231 FT.												
ELEVATION DIFFERENCE = 19.4 FT.												
STATION LENGTH = 5250 FT.												
ELEVATION DIFFERENCE = 484.2 FT.												
SYSTEM LENGTH = 13,173 FT.												
SYSTEM ELEVATION DIFFERENCE = 935.6 FT.												
N2.	PT.	100	90	80	70	60	50	40	30	20	10	
Q	(CFS)	21.66	21.14	20.44	19.55	18.32	16.65	14.62	11.97	8.40	4.36	AVERAGE
P		10.8	11.3	11.8	12.4	13.4	14.5	15.7	17.0	18.4	19.4	
P	H'	25.0	26.1	27.3	28.6	31.0	33.5	36.3	39.3	42.5	44.8	
S		22.5	21.3	20.1	18.8	16.4	13.9	11.1	8.3	4.9	2.6	
A		104.6	105.2	104.9	104.0	105.0	104.3	103.4	100.4	92.5	67.6	102.7
P		36.9	38.4	40.4	42.3	45.0	49.8	53.8	58.4	62.9	66.4	
P	H'	85.2	88.7	93.3	97.7	104.0	115.0	124.3	134.9	145.3	153.4	
S		68.4	64.9	60.3	55.9	49.7	38.6	29.3	18.7	8.3	0.2	
R		120.0	120.4	123.2	120.7	120.6	125.0	128.0	133.6	145.5	165.7	139.0
P		30.3	34.3	38.8	44.3	51.6	59.7	68.5	79.1	90.2	96.7	
P	H'	70.0	79.2	89.8	102.3	119.2	137.9	158.2	182.7	208.4	223.4	
S		161.0	151.8	141.4	128.7	111.8	93.1	72.7	48.3	22.6	7.6	
C		105.4	106.1	106.6	107.3	108.5	108.9	109.3	111.6	118.1	110.5	109.2
P		-8.8	-7.8	-6.8	-5.3	-3.8	-1.8	1.3	3.8	5.8	8.9	
P	H'	-20.3	-18.0	-15.7	-12.2	-8.8	-4.2	3.0	8.8	13.4	20.6	
S		39.7	37.4	35.1	31.6	28.2	23.6	16.4	10.6	6.0	-1.2	
D		119.0	119.9	120.0	121.5	121.0	121.1	129.5	134.2	128.1	XXX.X	123.8
P		99.8	103.8	109.8	118.3	131.8	143.8	158.7	173.7	192.7	203.1	
P	H'	230.5	239.8	253.6	273.3	304.5	332.2	366.6	401.2	445.1	469.2	
S		253.7	244.4	230.6	210.8	179.7	152.0	117.6	83.0	39.1	15.0	
E		95.6	95.2	95.0	95.3	97.4	96.9	97.8	96.6	102.0	88.8	96.9
T		170.0	180.0	194.0	212.0	238.0	266.0	298.0	332.0	370.0	394.5	
O	L	392.7	415.8	448.1	489.7	540.8	614.5	686.4	766.9	854.7	911.3	
T		542.9	519.8	487.5	445.9	385.8	321.1	247.2	168.7	60.9	24.3	
L	E	104.2	104.1	104.2	104.6	106.0	106.4	107.6	108.3	113.1	112.4	107.1



△ Sherwin
3243

11

12

7

Creek

Sherwin Bar

JEEP TRAIL 3054

14

13

18

SALMON RIVER

BM 1603

Power line

Chief Joseph War Historical Marker

BM 1613

Cem

Creek

John Day Bar

John Day

23

24

19

John 3657

Johnson Bar

BM 1626

95

Mines

JEEP

26

25

30

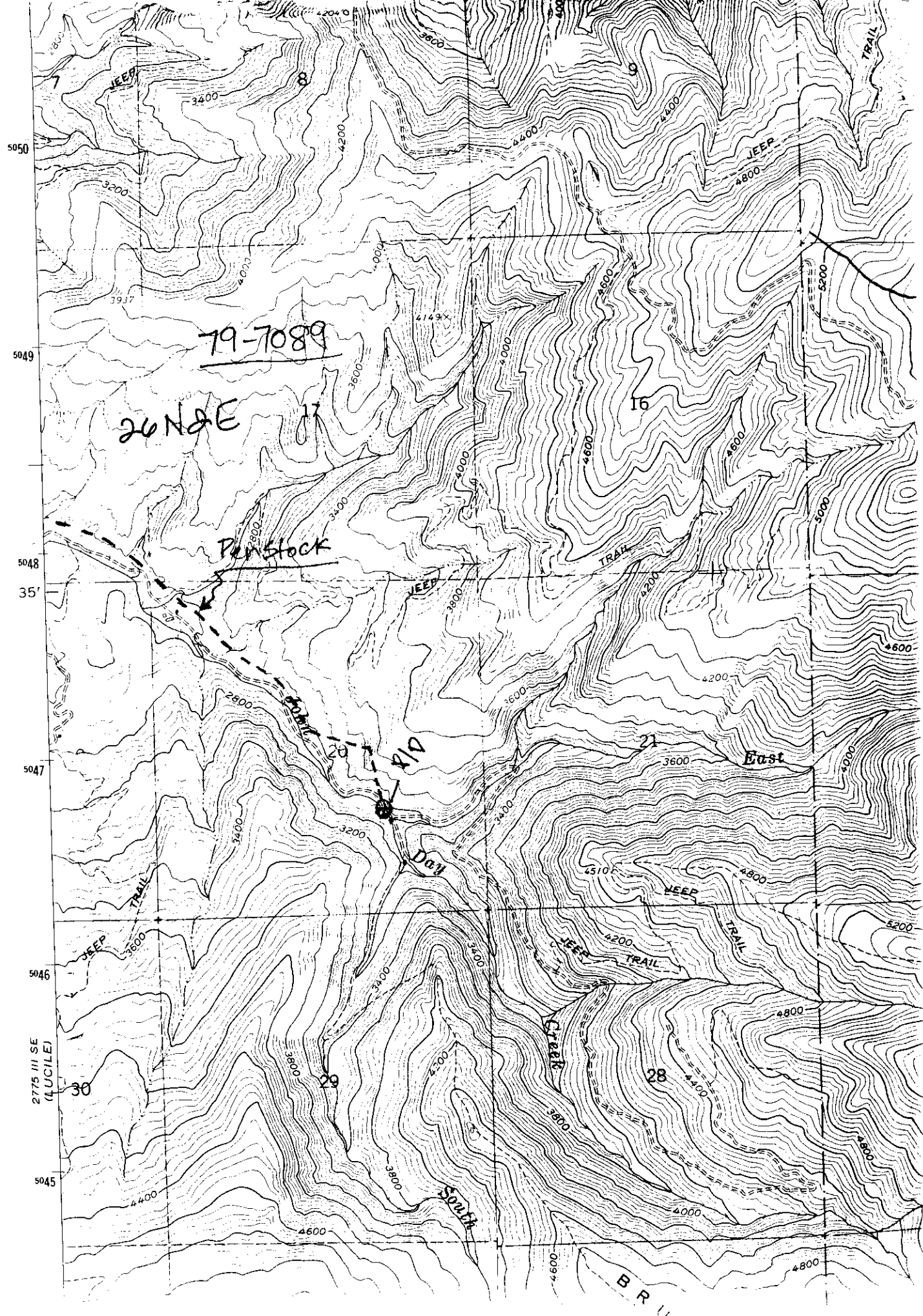
Butcher Bar

Wet TRAIL

Gulch

4445

JEEP TRAIL



79-7089

26 N&E

Penstock

RID

Day

East

South

B R I

2775 III SE
(LUCILE)

79-7089



P/W.
Powerhouse
&
Control Panel



79-7089



P/D

Shows creek channel &
diversion dam, collection
Structure with ~~to~~^{Sorely} gate
to control minimum
req'd flow in channel,
hydraulic gate to
penstock.

79-7089

David Cereghino's
JOHN DAY CREEK
Hydroelectric Generation Station

Evaluation of Performance Test Data

Gary W. Lawson
The Washington Water Power Company
Power Supply Department
June 8, 1989

FACILITY

The John Day Creek Hydroelectric Generating Station ("project") consists of a diversion of John Day Creek, on the John Day Ranch, near Lucile, Idaho. John Day Creek is small creek which discharges into the Salmon River. River flows are diverted into a small intake structure, fed through a single penstock with a drop of approximately 940 feet and a length over 13,000 feet, and directed through a single impulse turbine. The turbine is connected to a 925 kW induction generator.

At the time of publication of this report, the project was limited to a maximum generating capability of approximately 650 kW, which is significantly lower than the design maximum of 917 kW. (This is 70% of design maximum output.) Penstock design problems have resulted in significant pressure loss at high flows, resulting in the lower output.

PURPOSE

The **Power Sales Agreement Between David Cereghino And The Washington Water Power Company** requires performance testing within the first year of operation of the project, and specifies the method of testing to be used. The project reached commercial operation on September 22, 1987.

Subsequent to the commercial operation date, the project was discovered to be limited in its generating capability (the limitation described above). In order to determine the source of the limitation, Flosonics, Inc. of Hermiston, Oregon was retained by Mr. Cereghino to perform some project testing. The testing determined that the project was limited due to penstock design. This set of performance tests were conducted in June, 1988.

The tests, however, were not performed specifically to meet the requirements of the Power Sales Agreement. Therefore, the testing methodology was different than prescribed by the Power Sales Agreement. Appendix A shows a copy of the Flosonics test results. The test results have been reviewed by Water Power, and for purposes of the contractual obligation for testing, Water Power will accept these results as adequate.

This document is to evaluate the results of project testing for the Project, and to estimate the annual project output under actual operating performance.

EVALUATION

This evaluation will be a three part evaluation. First, a correlation between project output and flow will be determined. Then, the correlation will be used to determine the estimated annual project generation under average historical water conditions. Finally, the estimated annual generation and output under actual performance conditions will be compared with the estimates made prior to project construction.

CORRELATION OF OUTPUT

Table 1 below shows the results of the performance testing. The extent of the project's generation limitation is apparent in the results.

Table 1
John Day Creek Hydroelectric Project
Project Output Verses Flow

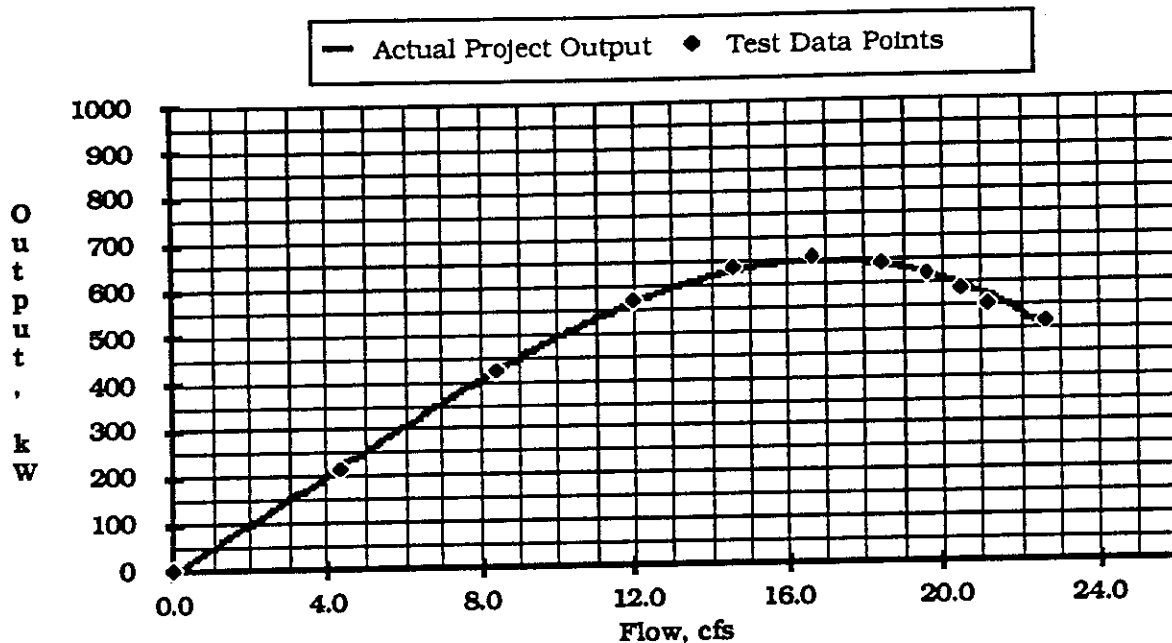
Flow (cfs)	Output (kW)
0.00	0
4.36	218
8.40	422
11.97	568
14.62	638
16.65	658
18.38	642
19.55	620
20.44	585
21.14	550
22.66	515

If the output can be expressed in a formula as a function of the flow through the project, then the project output can be calculated at any flow. To determine a formula which represents the operation of the project, a regression of the data points was performed. Appendix B shows the regression performed on the data. The resulting performance formula is:

$$\text{Output} = 47.93670320 * \text{Flow} + 1.17291799 * \text{Flow}^2 - 0.10243658 * \text{Flow}^3 - 0.06349812$$

Figure 1, shows the correlation curve resulting from the regression of the data.

Figure 1
John Day Creek Hydroelectric Project
Project Output Verses Flow
Based on Regression Correlation. Test Data Points Shown.



ESTIMATE OF ANNUAL GENERATION

The correlation was used to estimate the annual generation of the project. Appendix C shows the calculations made. The stream-flow estimates employed were those used by Meyers Engineering in determining the pre-construction generation estimates.

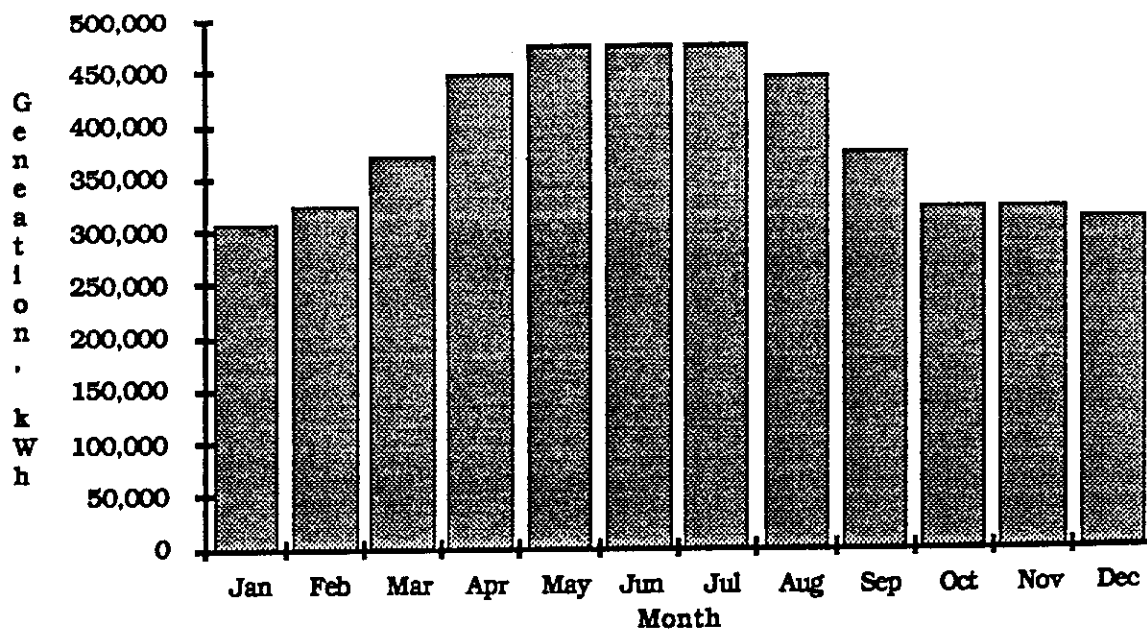
To perform the calculations, it was assumed that the project operating flows would never exceed 16.9 cfs. In looking at Figure 1, it can be seen that the project output peaks at 651 kW when the flow through the project is 16.9 cfs. Thus, to maximize output the project should not be operated at greater than 16.9 cfs flows, even if sufficient water is available in the creek.

Table 2 shows the resulting generation estimates by month, and Figure 2 graphically depicts the generation estimates.

Table 2
John Day Creek Hydroelectric Project
Estimated Generation By Month
Based On Actual Project Performance

Month (kWh)	Generation (kWh)
January	307,838
February	325,639
March	372,786
April	448,373
May	474,954
June	474,954
July	474,954
August	445,433
September	375,222
October	321,394
November	321,394
<u>December</u>	<u>312,932</u>
Total Annual	4,655,873

Figure 2
John Day Creek Hydroelectric Project
Estimated Generation By Month
Based On Actual Project Performance



COMPARISON OF ACTUAL OUTPUT WITH PRECONSTRUCTION ESTIMATE

The calculation of the preconstruction estimate of generation and output is shown in Appendix D. This is the estimate produced by Meyers Engineering. Figure 3 below shows a graphic comparison of the preconstruction estimate of the project output verses flow and the actual project output verses flow.

Figure 3
John Day Creek Hydroelectric Project
Comparison Of Output Performance

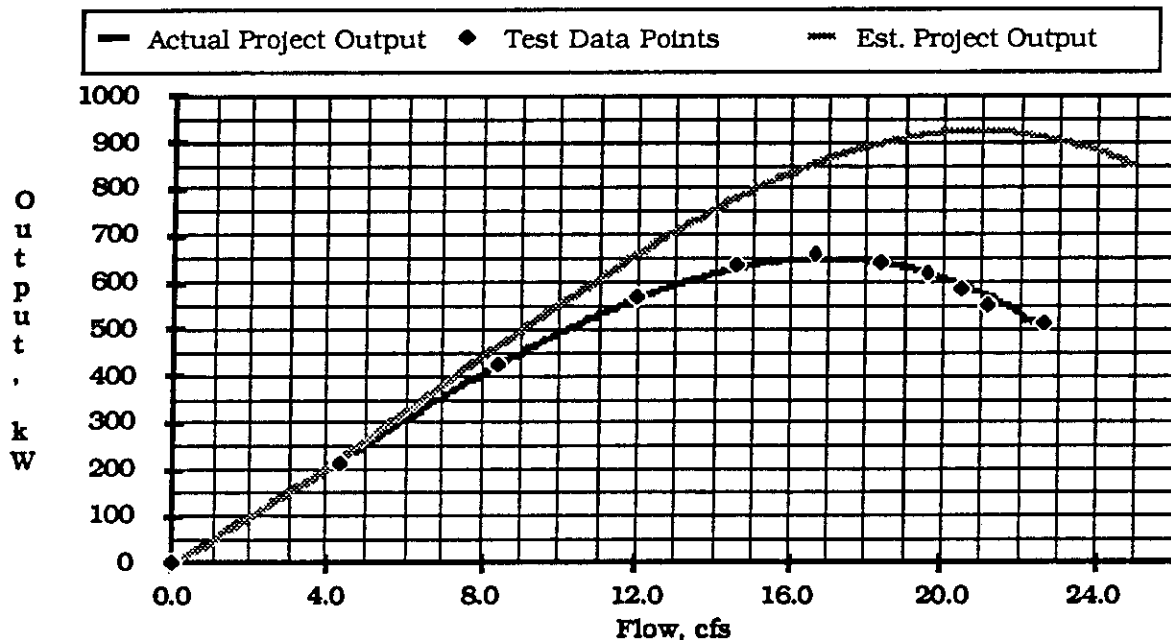
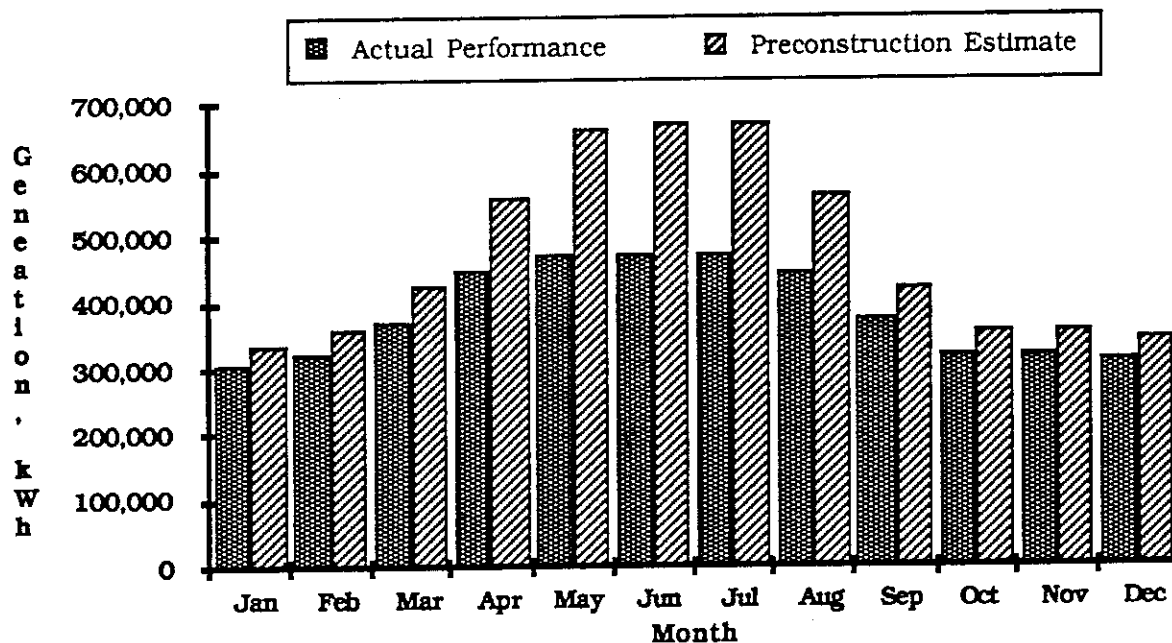


Table 3 shows the monthly generation estimates based upon the project's performance expected prior to its construction. Figure 4 shows a comparison of the preconstruction generation estimate with the estimate based upon actual project performance.

Table 3
John Day Creek Hydroelectric Project
Estimated Generation By Month
Based On Preconstruction Performance Estimate

Month (kWh)	Generation (kWh)
January	336,953
February	359,815
March	424,419
April	561,006
May	661,272
June	669,544
July	669,544
August	563,268
September	421,536
October	354,911
November	354,911
<u>December</u>	<u>343,861</u>
Total Annual	5,721,040

Figure 4
John Day Creek Hydroelectric Project
Comparison Of Output Performance



As can be seen from Figure 4, most of the reduction in annual generation occurs in the April through August period. These are the highest flow months, so this result is to be expected. The extent of the reduction in estimated annual generation, can be calculated as follows.

$$\text{Reduced Generation} = \frac{\text{Current Generation Estimate}}{\text{Preconstruction Generation Estimate}} \times 100$$

$$\text{Reduced Generation} = \frac{4655873}{5721040} \times 100$$

$$\text{Reduced Generation} = 81.4\%$$

Thus, the reduction to 70% of the project's maximum estimated output results in the project being able to produce 81.4% of the annual estimated generation.

June 8, 1989

John Day Creek Performance Test Analysis

Appendix A
Flosonics Performance Test Results

FIELD DATA

JOHN DAY CREEK HYDRO PROJECT
LUCILE, IDAHO
DAVE CEREGHINO

DATE: 6-14-1988

NOZZLE PT %	# 1 PSI	# 2 PSI	# 3 PSI	# 4 PSI	# 5 PSI	FLOW CFS	ROD READ OFF BENCH
0	18.5	87.7	190.0	196.0	406.0	0	7.42
100	10.8	48.0	82.0	71.0	173.0	22.66	7.86
90	11.3	50.0	87.0	77.0	183.0	21.14	7.85
80	11.8	52.5	94.0	85.0	197.0	20.44	7.88
70	12.4	55.0	102.0	94.5	215.0	19.55	7.87
60	13.4	58.8	113.0	107.0	240.0	18.32	7.80
50	14.5	64.8	127.0	123.0	268.0	16.65	7.77
40	15.7	70.0	141.0	140.0	300.0	14.62	7.73
30	17.0	76.0	157.5	159.0	334.0	11.97	7.66
20	18.4	82.0	174.5	178.0	371.0	8.40	7.60
10	19.4	86.5	185.5	192.0	395.5	4.36	7.5
			B.S.	H.I.	F.S.		
BENCH ELEVATION			0.20	2896.9		2896.7	
TOP OF HEADWALL					5.93	2891.0	

THESE VALUES REPRESENT THE PRESSURE VALUES AT EACH STATION
AS READ BY RONALD V. MCKINNIS, P.E., FLOSONICS, INC. AND
DOUG STAKER, ENGINEER, MYERS ENGINEERING COMPANY
RECORDED ON JUNE 14, 1988

FIELD DATA

JOHN DAY CREEK HYDRO PROJECT
LUCILE, IDAHO
DAVE CEREGHINO

DATE: 6-14-1988

NOZZLE PT %	AC AMPS	AC VOLTS	POWER FACTOR	AC KW	RPM	TIME
100	84.0	4100	0.83	515	1200	2:45
	87.0	4100				
	88.0	4100				
90	89.0	4100	0.825	550	1200	3:30
	93.0	4120				
	92.0	4110				
80	94.0	4100	0.83	585	1200	4:00
	99.0	4120				
	96.0	4110				
70	98.0	4100	0.84	620	1200	4:30
	102.0	4130				
	102.0	4120				
60	101.0	4100	0.85	642	1200	5:10
	106.0	4150				
	105.0	4120				
50	103.0	4100	0.86	658	1200	5:35
	107.0	4110				
	108.0	4110				
40	102.0	4100	0.85	638	1200	5:55
	103.0	4120				
	103.0	4110				
30	92.0	4100	0.84	568	1200	6:15
	94.0	4100				
	95.0	4100				
20	72.0	4090	0.81	422	1200	6:55
	76.0	4100				
	75.0	4100				
10	72.0	4040	0.64	218	1190	7:15
	76.0	4080				
	75.0	4070				

FIELD DATA

JOHN DAY CREEK HYDRO PROJECT
LUCILE, IDAHO
DAVE CERECHINO

DATE: 6-14-1988

PIPE INFORMATION

MATERIAL : STEEL
CIRCUMFERENCE : 56.80
OUTSIDE DIA : 18.08
INSIDE DIA : 17.59

FLOW INFORMATION

TEST #	WESTINGHOUSE		POLYSONICS		PERCENTAGE VARIANCE
	GPM	CFS	GPM	CFS	
100%	9723	21.66	9752	21.72	0.30%
90%	9493	21.15	9459	21.07	0.36%
80%	9172	20.44	9164	20.42	0.09%
70%	8776	19.55	8772	19.54	0.05%
60%	8224	18.32	8213	18.30	0.13%
50%	7474	16.65	7465	16.63	0.12%
40%	6563	14.62	6577	14.65	0.21%
30%	5371	11.97	5405	12.04	0.63%
20%	3768	8.40	3786	8.44	0.48%
10%	1955	4.36	1938	4.31	0.88%

NOTE:

The WESTINGHOUSE METER CONSTANT was 2.184×10^{-6} for tests 100% through 40%. Tests 30% and 20% the value of 3.641×10^{-6} was used and 7.282×10^{-6} was used for 10%.

NOTE:

STATISTICAL ANALYSIS

MEAN- .325

ST.DE- .27

JOHN DAY CREEK HYDRO PROJECT
LUCILE, IDAHO
DAVE CEREGHINO

DATE: 6-15-1988

SECTION INFORMATION

PRESS. STATION #	# 0	# 1	# 2	# 3	# 4	# 5
CONSTR. STATION	0+00	5+50	27+04	66+92	79+23	131+73
ELEVATION (FT)	2890.0	2841.7	2681.9	2442.7	2430.5	1951.0
STATIC PRESS. (PSI)	0	18.5	87.7	190.0	196.0	406.0
STATIC PRESS. (FT)	0	42.7	206.6	438.9	452.8	937.9

THE ELEVATIONS AND CONSTRUCTION STATIONING OF THE PRESSURE STATIONS WERE FURNISHED BY MYERS ENGINEERING COMPANY

THE SYSTEM IS BROKEN UP INTO FIVE (5) PIPE SECTIONS
I.E. P.S. 'A' THROUGH P.S. 'E'
THESE SECTIONS HAVE THE FOLLOWING CHARACTERISTICS:

SECTIONS BETWEEN PRESSURE STATIONS

STA # TO STA #	#0 - #1	#1 - #2	#2 - #3	#3 - #4	#4 - #5
SECTION NAME	P.S. 'A'	P.S. 'B'	P.S. 'C'	P.S. 'D'	P.S. 'E'
STA LENGTH (FT)	550	2154	3988	1231	5250
ELEV. DIFF. (FT)	47.6	159.8	239.2	12.2	479.5
PRESS. DIFF. (FT)	42.7	159.9	236.3	13.9	485.1

THE DISCREPANCIES IN ELEVATION AND PRESSURE DIFFERENCES COULD BE THE RESULT OF EITHER LEVELING ERRORS OR GAUGE READINGS OR A COMBINATION OF BOTH. FOR EVALUATION OF THE SECTION PROPERTIES, VALUES OF PRESSURE DIFFERENCES AT STATIC CONDITIONS WILL BE USED FOR THE ELEVATION CHANGES BETWEEN THE PRESSURE STATIONS IN THIS SYSTEM STUDY.

JOHN DAY CREEK HYDRO PROJECT
LUCILE, IDAHO
DAVE CEREGHINO

DATE: 6-16-1988

PRESSURE GAUGE CALIBRATION FACTORS
FOR ALL GAUGES USED ON THE SYSTEM

GAUGE # 1 0 - 30 PSI	GAUGE # 2 0 - 140 PSI	GAUGE # 3 0 - 600 PSI	GAUGE # 4 0 - 200 PSI
0 = 0	0 = 2.0	0 = -3.0	0 = -1.0
10 = 10	50 = 49.7	150 = 147.0	100 = 99.2
20 = 20	100 = 99.1	300 = 298.0	195 = 194.4
30 = 30	195 = 191.8	450 = 449.0	
		590 = 588.0	

THE GAUGES WERE POSITIONED AT THE FOLLOWING LOCATIONS:

GAUGE # 1 @ PRESSURE STATION # 1
GAUGE # 2 @ PRESSURE STATION # 2
GAUGE # 3 @ PRESSURE STATIONS # 3 & # 5
GAUGE # 4 @ PRESSURE STATION # 4

WITH THE FIELD GAUGES BEING CALIBRATED AGAIN FOLLOWING THE FIELD STUDY, THE FIELD PRESSURE STATION VALUES MUST BE ADJUSTED ACCORDING TO THE ABOVE CRITERIA. THESE ADJUSTED PRESSURE VALUES ARE AS FOLLOWS:

NOZZLE PT %	# 1 PSI	# 2 PSI	# 3 PSI	# 4 PSI	# 5 PSI	FLOW CFS
0	20.5	87.0	187.0	195.4	405.0	0
100	10.8	47.7	79.0	70.2	170.0	21.66
90	11.3	49.7	84.0	76.2	180.0	21.14
80	11.8	52.2	91.0	84.2	194.0	20.44
70	12.4	54.7	99.0	93.7	212.0	19.55
60	13.4	58.4	110.0	106.2	238.0	18.32
50	14.5	64.3	124.0	122.2	266.0	16.65
40	15.7	69.5	138.0	139.3	298.0	14.62
30	17.0	75.4	154.5	158.3	332.0	11.97
20	18.4	81.3	171.5	177.3	370.0	8.40
10	19.4	85.8	182.5	191.4	394.5	4.36

THE ABOVE PRESSURE VALUES WILL BE USED IN THE SYSTEM'S STUDY

JOHN DAY CREEK HYDRO PROJECT
LUCILE, IDAHO
DAVE CEREGHINO

DATE: 6-15-1988
REVISED ON 6-16-1988

DUE TO POST FIELD WORK CALIBRATION OF THE FIELD GAUGES
THE SECTION CHARACTERISTICS ARE ADJUSTED ACCORDING TO THE
GAUGE CALIBRATION CRITERIA AS SHOWN PREVIOUSLY

THE ADJUSTED VALUES ARE AS FOLLOWS:

SECTION INFORMATION

PRESS. STATION #	# 0	# 1	# 2	# 3	# 4	# 5
CONSTR. STATION	0+00	5+50	27+04	66+92	79+23	131+73
ELEVATION (FT)	2890.0	2841.7	2681.9	2442.7	2430.5	1951.0
STATIC PRESS. (PSI)	0	20.5	87.0	187.0	195.4	405.0
STATIC PRESS. (FT)	0	47.4	201.0	432.0	451.4	935.6

SECTIONS

STA # TO STA #	#0 - #1	#1 - #2	#2 - #3	#3 - #4	#4 - #5
SECTION NAME	P.S. 'A'	P.S. 'B'	P.S. 'C'	P.S. 'D'	P.S. 'E'
STA LENGTH (FT)	550	2154	3988	1231	5250
ELEV. DIFF. (FT)	47.6	159.8	239.2	12.2	479.5
PRESS. DIFF. (FT)	47.4	153.6	231.0	19.4	484.2

THE STATION LENGTH AND PRESSURE DIFFERENCE VALUES WILL
BE USED IN THE SYSTEM'S STUDY

JOHN DAY CREEK HYDRO PROJECT											
LUCILE, IDAHO											
DAVE CERRECHINO											
P' - PRESSURE DIFFERENCE IN SECTION In (PSI)											
H' - PRESSURE DIFFERENCE IN SECTION In (FT)											
Hf - FRICTION LOSS IN SECTION In (FT)											
"C" - HAZEN-WILLIAMS CALCULATED ROUGHNESS COEFFICIENT											
N02.	PT.	100	90	80	70	60	50	40	30	20	10
Q (CFS)		21.66	21.14	20.44	19.55	18.32	16.65	14.62	11.97	8.40	4.36
	AVERAGE										
P.		10.8	11.3	11.8	12.4	13.4	14.5	15.7	17.0	18.4	19.4
P.	H'	25.0	26.1	27.3	28.6	31.0	33.5	36.3	39.3	42.5	44.8
S.	Hf	22.5	21.3	20.1	18.8	16.4	13.9	11.1	8.1	4.9	2.6
'A'											
P.	H'	104.6	105.2	104.9	104.0	105.0	104.3	103.4	100.4	92.5	67.6
P.	H'	36.9	38.4	40.4	42.3	45.0	49.8	53.8	58.4	62.9	66.4
S.	H'	85.2	80.7	93.3	97.7	104.0	115.0	124.3	134.9	145.3	153.4
'B'											
P.	H'	120.0	120.4	121.2	120.7	120.6	125.0	128.0	133.6	145.5	156.7
P.	H'	30.3	34.3	38.8	44.3	51.6	59.7	68.5	79.1	90.2	96.7
S.	H'	70.0	79.2	89.8	102.3	119.2	137.9	158.2	182.7	208.4	223.4
'C'											
P.	H'	161.0	151.8	143.4	128.7	113.8	93.1	72.7	48.3	22.8	7.6
P.	H'	105.4	106.1	106.6	107.3	108.5	108.9	109.3	111.6	118.1	110.5
P.	H'	8.8	7.8	6.8	5.3	3.8	1.8	1.3	3.8	5.8	8.9
P.	H'	20.3	18.0	15.7	12.2	8.8	4.2	3.0	8.8	13.4	20.6
S.	Hf	39.7	37.4	35.1	31.6	28.2	23.6	16.4	10.6	6.0	1.2
'D'											
P.	H'	119.0	119.9	120.0	121.5	121.0	121.1	129.5	134.2	128.1	123.8
P.	H'	99.8	103.8	109.8	118.3	131.8	143.8	158.7	173.7	192.7	203.1
P.	H'	230.5	239.8	253.6	273.3	304.5	332.2	366.6	401.2	445.1	469.2
S.	Hf	253.7	244.4	230.6	210.9	179.7	152.0	117.6	83.0	39.1	15.0
'E'											
P.	H'	95.6	95.2	95.0	95.3	97.4	96.9	97.8	96.6	102.0	88.8
P.	H'	170.0	180.0	194.0	212.0	238.0	266.0	298.0	332.0	370.0	394.5
T											
O L	H'	392.7	415.8	448.1	489.7	549.8	614.5	688.4	766.9	854.7	911.3
T											
A N	H'	542.9	519.8	487.5	445.9	385.8	321.1	247.2	168.7	80.9	24.3
L E											
P.	H'	104.2	104.1	104.2	104.6	106.0	106.4	107.6	108.3	113.1	112.4
P.											

STATION LENGTH = 550 FT.
ELEVATION DIFFERENCE = 47.4 FT.

STATION LENGTH = 2154 FT.
ELEVATION DIFFERENCE = 153.6 FT.

STATION LENGTH = 3980 FT.
ELEVATION DIFFERENCE = 231.0 FT.

STATION LENGTH = 1231 FT.
ELEVATION DIFFERENCE = 19.4 FT.

STATION LENGTH = 5250 FT.
ELEVATION DIFFERENCE = 484.2 FT.

SYSTEM LENGTH = 13,173 FT.
SYSTEM ELEVATION DIFFERENCE = 935.6 FT.

STATION LENGTH = 550 FT.

ELEVATION DIFFERENCE = 47.4 FT.

STATION LENGTH = 2154 FT.

ELEVATION DIFFERENCE = 159.6 FT.

STATION LENGTH = 3988 FT.

ELEVATION DIFFERENCE = 231.0 FT.

STATION LENGTH = 1231 FT.

ELEVATION DIFFERENCE = 19.4 FT.

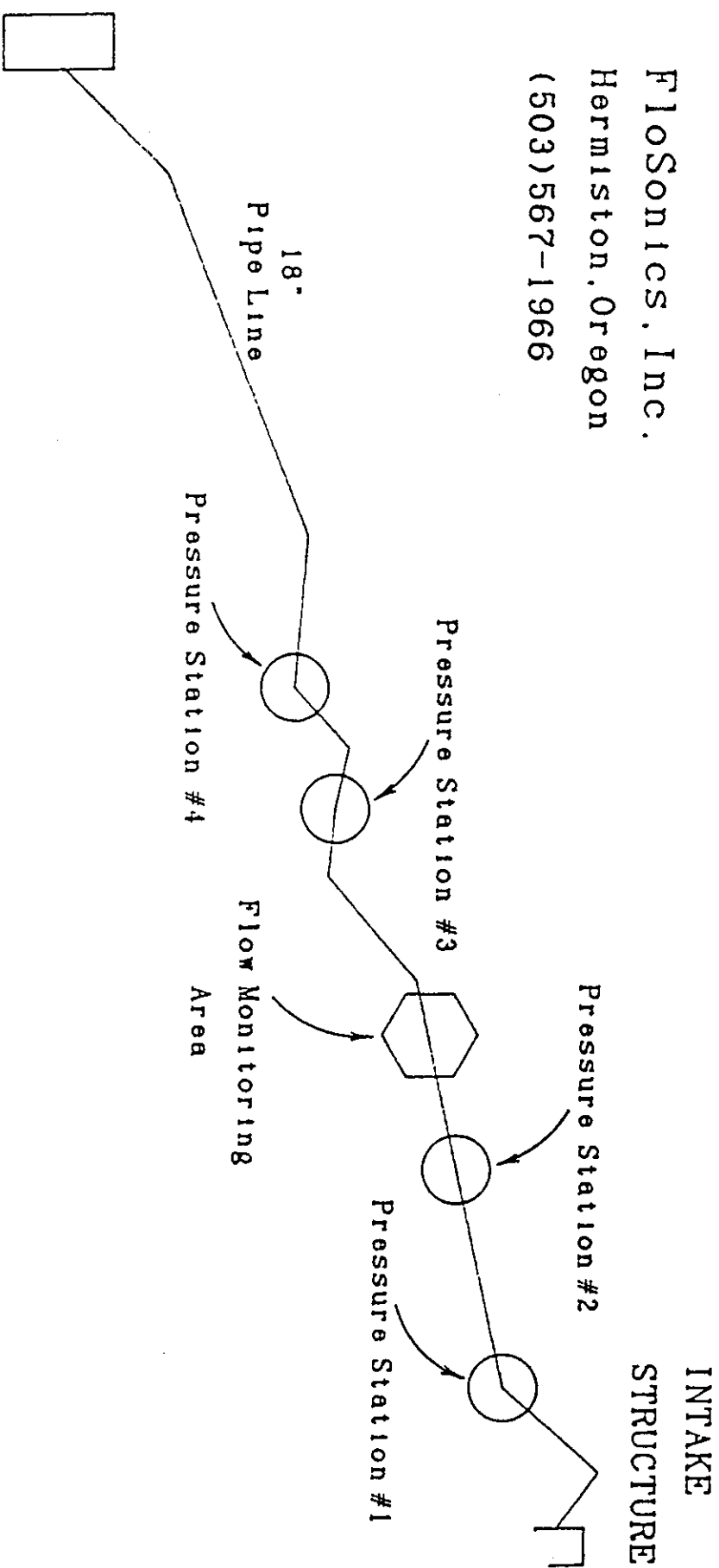
STATION LENGTH = 5250 FT.

ELEVATION DIFFERENCE = 484.2 FT.

SYSTEM LENGTH = 13,173 FT.

SYSTEM ELEVATION DIFFERENCE = 935.6 FT.

FloSonics, Inc.
Hermiston, Oregon
(503) 567-1966



POWERHOUSE
& Pressure Station #5

(no scale)

System Layout for
JOHN DAY CREEK HYDRO PROJECT
LUCILE, IDAHO
Dave Cereghino

FLOSONICS, INC
HERMISTON, OREGON
(503) 567-1966

JOHN DAY CREEK HYDRO PROJECT

LUCILE, IDAHO

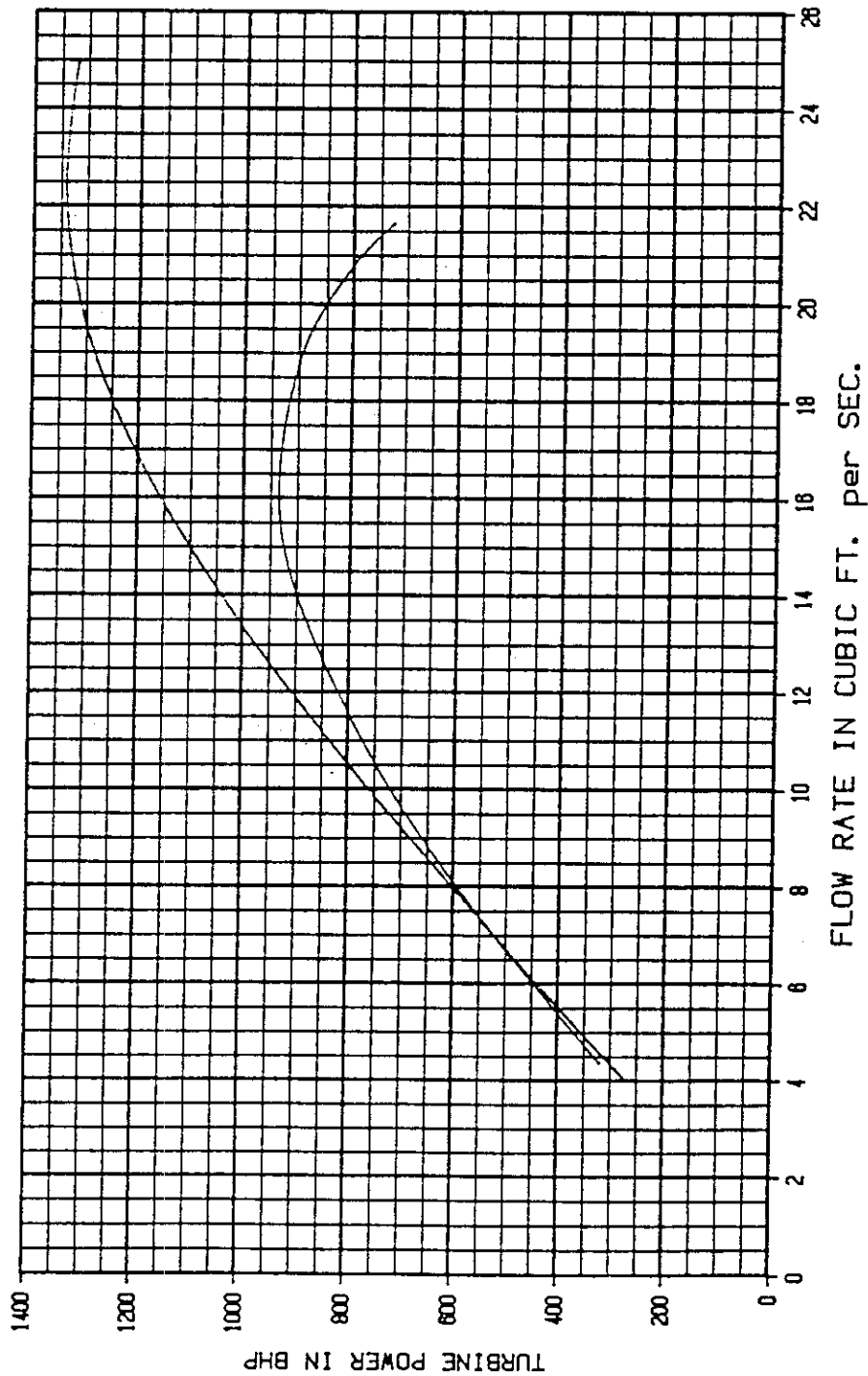
DAVE CERECHINO

GILKES TURBINE NO. 56317
RATED OUTPUT 1368 BHP
RATED NET HEAD 609 FEET
RATED FLOW 22.9 CFS
SPEED 1200 RPM

— PERF. CURVE

POWER VS. FLOW

— TURB. CURVE





WESTCON INC.

5101 NORTH INTERSTATE AVENUE · PORTLAND, OREGON 97217 · PHONE (503) 283-0132

CERTIFICATE OF CONFORMANCE/CALIBRATION

CERTIFICATION NUMBER: 91039-F DATE: 880616
PERFORMED FOR: FLOSONICS
GOVERNING PURCHASE ORDER: 061688
MANUFACTURER: MARSH MODEL: D0264Z
 SERIAL NUMBER: 3684
DESCRIPTION: MASTER TEST GAUGE

As requested, the instrument cited above was tested and inspected by Westcon personnel. The instrument was found to be in satisfactory physical condition. Its performance was not within specifications published by the manufacturer. The instrument was recalibrated to correct this condition, and final test results verify satisfactory instrument performance.

The instrument is hereby released with a CLASS 1 CERTIFICATION. This certification of performance is based on a transfer of standards from the U.S. National Bureau of Standards and/or other international standards organizations.

All tests and inspections were conducted in a clean environment, and in accordance with procedures derived from manufacturer's specifications or National Bureau of Standards guides. All facets of this certification comply with the applicable sections of 10 CFR 50, ANSI N45.2, MIL-STD-45662, MIL-Q-9858A, and Westcon Procedures. (SEE REVERSE SIDE)

The following instruments were used to establish NBS traceability:

MANUFACTURER	MODEL	S/N	RE-CERT DUE
AMETEK	TQ-150	10341	880711

NBS TRACE NUMBERS:

P7686	7732	212.31/193712	232.09/
210099	210359	208987	210073
ADDL			

Certified by: *John Moore Lab Manager*
Steven Crane Recommended recall: 881216

When data is supplied by Westcon, the following rules apply:

- 1) Data in the column labeled 'Standard' always refers to readings taken from Westcon standards.
- 2) Data in the column labeled 'IUT' always refers to readings taken from the instrument under test.
- 3) 'I' and 'F' refer to initial and final data respectively.
- 4) 'R', 'F', and 'S' refer to the type of method used to calculate error, when appropriate.

Standard error computation formulae are as follows:

$$\%Error (R) = ((IUT/STD)-1)*100$$

$$\%Error (F) = (IUT-STD)*100/FS$$

$$\%Error (S) = (IUT-STD)*100/(ABS(LOW-HIGH))$$

Any error computed here has been rounded off. These may be used to compute error if greater resolution is required.

Line	Data	Standard	IUT	Type	Other	%Error
1	I	0	*-3		0-600 PSI	
2	I	150	*147		0-600 PSI	
3	I	300	*298		0-600 PSI	
4	I	450	449		0-600 PSI	
5	I	590	*588		0-600 PSI	
6	F	0	-1		0-600 PSI	
7	F	150	149		0-600 PSI	
8	F	300	300.5		0-600 PSI	
9	F	450	450.5		0-600 PSI	
10	F	590	590.5		0-600 PSI	

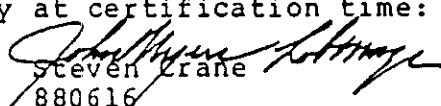
INITIAL CALIBRATION OUT OF TOLERANCE AS INDICATED BY AN(*)ASTERISK
UNIT NOW MEETS MANUFACTURERS SPECIFICATION OF ANSI GRADE "3A".

Principle procedure used: WP-26 Revision 0

Quality System based on Westcon QA Manual Revision 4, of 820626.

Laboratory temperature at certification time: 20C

Laboratory humidity at certification time: 48%RH

Data certified by:  Steven Crane

Data certified on: 880616



WESTCON INC

5101 NORTH INTERSTATE AVENUE · PORTLAND, OREGON 97217 · PHONE (503) 283-0132

CERTIFICATE OF CONFORMANCE/CALIBRATION

CERTIFICATION NUMBER: 91040-F DATE: 880616
PERFORMED FOR: FLOSONICS
GOVERNING PURCHASE ORDER: 061688
MANUFACTURER: ASHCROFT MODEL: 1000
 SERIAL NUMBER: 3685
DESCRIPTION: PRESSURE GAGE

As requested, the instrument cited above was tested and inspected by Westcon personnel. The instrument was found to be in satisfactory physical condition, and its performance was found to be within applicable specifications published by the manufacturer.

The instrument is hereby released with a CLASS 1 CERTIFICATION. This certification of performance is based on a transfer of standards from the U.S. National Bureau of Standards and/or other international standards organizations.

All tests and inspections were conducted in a clean environment, and in accordance with procedures derived from manufacturer's specifications or National Bureau of Standards guides. All facets of this certification comply with the applicable sections of 10 CFR 50, ANSI N45.2, MIL-STD-45662, MIL-Q-9858A, and Westcon Procedures. (SEE REVERSE SIDE)

The following instruments were used to establish NBS traceability:

MANUFACTURER	MODEL	S/N	RE-CERT DUE
NEWPORT/SETRA	100 PSIG	3515	881120

NBS TRACE NUMBERS:

P7686	7732	212.31/193712	232.09/
210099	210359	208987	210073
ADL			

Certified by: *Steven Crane* Lab Manager Recommended recall: 881216

When data is supplied by Westcon, the following rules apply:

- 1) Data in the column labeled 'Standard' always refers to readings taken from Westcon standards.
- 2) Data in the column labeled 'IUT' always refers to readings taken from the instrument under test.
- 3) 'I' and 'F' refer to initial and final data respectively.
- 4) 'R', 'F', and 'S' refer to the type of method used to calculate error, when appropriate.

Standard error computation formulae are as follows:

$$\%Error (R) = ((IUT/STD)-1)*100$$

$$\%Error (F) = (IUT-STD)*100/FS$$

$$\%Error (S) = (IUT-STD)*100/(ABS(LOW-HIGH))$$

Any error computed here has been rounded off. These may be used to compute error if greater resolution is required.

Line	Data	Standard	IUT	Type	Other	%Error
1	I	0	0		0-30 PSI	
2	I	5	4.96		0-30 PSI	
3	I	10	9.98		0-30 PSI	
4	I	15	15.15		0-30 PSI	
5	I	20	20.20		0-30 PSI	
6	I	25	25.08		0-30 PSI	
7	I	30	29.91		0-30 PSI	

UNIT MEETS MANUFACTURERS SPECIFICATION OF ANSI GRADE "B".

Principle procedure used: WP-26 Revision 0

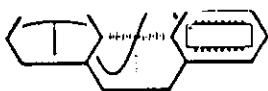
Quality System based on Westcon QA Manual Revision 4, of 820626.

Laboratory temperature at certification time: 20C

Laboratory humidity at certification time: 48%RH

Data certified by: Steven Crane

Data certified on: 880616



WESTCON INC.

5101 NORTH INTERSTATE AVENUE · PORTLAND, OREGON 97217 · PHONE (503) 283-0132

CERTIFICATE OF CONFORMANCE/CALIBRATION

CERTIFICATION NUMBER: 91041-F DATE: 880616
PERFORMED FOR: FLOSONICS
GOVERNING PURCHASE ORDER: 061688
MANUFACTURER: ASHCROFT MODEL: 1082AS
SERIAL NUMBER: 83085-2

DESCRIPTION: TEST GAUGE

As requested, the instrument cited above was tested and inspected by Westcon personnel. The instrument was found to be in satisfactory physical condition. Its performance was not within specifications published by the manufacturer. The instrument was recalibrated to correct this condition, and final test results verify satisfactory instrument performance.

The instrument is hereby released with a CLASS 1 CERTIFICATION. This certification of performance is based on a transfer of standards from the U.S. National Bureau of Standards and/or other international standards organizations.

All tests and inspections were conducted in a clean environment, and in accordance with procedures derived from manufacturer's specifications or National Bureau of Standards guides. All facets of this certification comply with the applicable sections of 10 CFR 50, ANSI N45.2, MIL-STD-45662, MIL-Q-9858A, and Westcon Procedures. (SEE REVERSE SIDE)

The following instruments were used to establish NBS traceability:

MANUFACTURER	MODEL	S/N	RE-CERT DUE
AMETEK	TQ-150	10341	880711

NBS TRACE NUMBERS:

P7686	7732	212.31/193712	232.09/
210099	210359	208987	210073
ADDL			

Certified by: *John M. L. Manager* Steven Crane Recommended recall: 881216

When data is supplied by Westcon, the following rules apply:

- 1) Data in the column labeled 'Standard' always refers to readings taken from Westcon standards.
- 2) Data in the column labeled 'IUT' always refers to readings taken from the instrument under test.
- 3) 'I' and 'F' refer to initial and final data respectively.
- 4) 'R', 'F', and 'S' refer to the type of method used to calculate error, when appropriate.

Standard error computation formulae are as follows:

$$\%Error (R) = ((IUT/STD)-1)*100$$

$$\%Error (F) = (IUT-STD)*100/FS$$

$$\%Error (S) = (IUT-STD)*100/(ABS(LOW-HIGH))$$

Any error computed here has been rounded off. These may be used to compute error if greater resolution is required.

Line	Data	Standard	IUT	Type	Other	%Error
1	I	0	*-2		0-200 PSI	
2	I	50	49.7		0-200 PSI	
3	I	100	*99.1		0-200 PSI	
4	I	195	*191.8		0-200 PSI	
5	F	0	-.5		0-200 PSI	
6	F	50	50.2		0-200 PSI	
7	F	100	100.5		0-200 PSI	
8	F	195	194.5		0-200 PSI	

INITIAL CALIBRATION OUT OF TOLERANCE AS INDICATED BY AN(*)ASTERISK
UNIT NOW MEETS MANUFACTURERS SPECIFICATION OF ANSI GRADE "3A".

Principle procedure used: WP-26 Revision 0

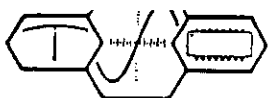
Quality System based on Westcon QA Manual Revision 4, of 820626.

Laboratory temperature at certification time: 20C

Laboratory humidity at certification time: 48%RH

Data certified by: Steven Crane

Data certified on: 880616



WESTCON INC.

5101 NORTH INTERSTATE AVENUE · PORTLAND, OREGON 97217 · PHONE (503) 283-0132

CERTIFICATE OF CONFORMANCE/CALIBRATION

CERTIFICATION NUMBER: 91042-F DATE: 880616
PERFORMED FOR: FLOSONICS
GOVERNING PURCHASE ORDER: 061688
MANUFACTURER: ASHCROFT MODEL: 1082AS
SERIAL NUMBER: 83085-1
DESCRIPTION: TEST GAUGE

As requested, the instrument cited above was tested and inspected by Westcon personnel. The instrument was found to be in satisfactory physical condition. Its performance was not within specifications published by the manufacturer. The instrument was recalibrated to correct this condition, and final test results verify satisfactory instrument performance.

The instrument is hereby released with a CLASS 1 CERTIFICATION. This certification of performance is based on a transfer of standards from the U.S. National Bureau of Standards and/or other international standards organizations.

All tests and inspections were conducted in a clean environment, and in accordance with procedures derived from manufacturer's specifications or National Bureau of Standards guides. All facets of this certification comply with the applicable sections of 10 CFR 50, ANSI N45.2, MIL-STD-45662, MIL-Q-9858A, and Westcon Procedures. (SEE REVERSE SIDE)

The following instruments were used to establish NBS traceability:

MANUFACTURER	MODEL	S/N	RE-CERT DUE
AMETEK	TQ-150	10341	880711

NBS TRACE NUMBERS:

P7686	7732	212.31/193712	232.09/
210099	210359	208987	210073
ADDL			

Certified by: *Steven Crane* *Lab Manager* Recommended Recall: 881216

When data is supplied by Westcon, the following rules apply:

- 1) Data in the column labeled 'Standard' always refers to readings taken from Westcon standards.
- 2) Data in the column labeled 'IUT' always refers to readings taken from the instrument under test.
- 3) 'I' and 'F' refer to initial and final data respectively.
- 4) 'R', 'F', and 'S' refer to the type of method used to calculate error, when appropriate.

Standard error computation formulae are as follows:

$$\% \text{Error (R)} = ((\text{IUT}/\text{STD}) - 1) * 100$$

$$\% \text{Error (F)} = (\text{IUT} - \text{STD}) * 100 / \text{FS}$$

$$\% \text{Error (S)} = (\text{IUT} - \text{STD}) * 100 / (\text{ABS}(\text{LOW} - \text{HIGH}))$$

Any error computed here has been rounded off. These may be used to compute error if greater resolution is required.

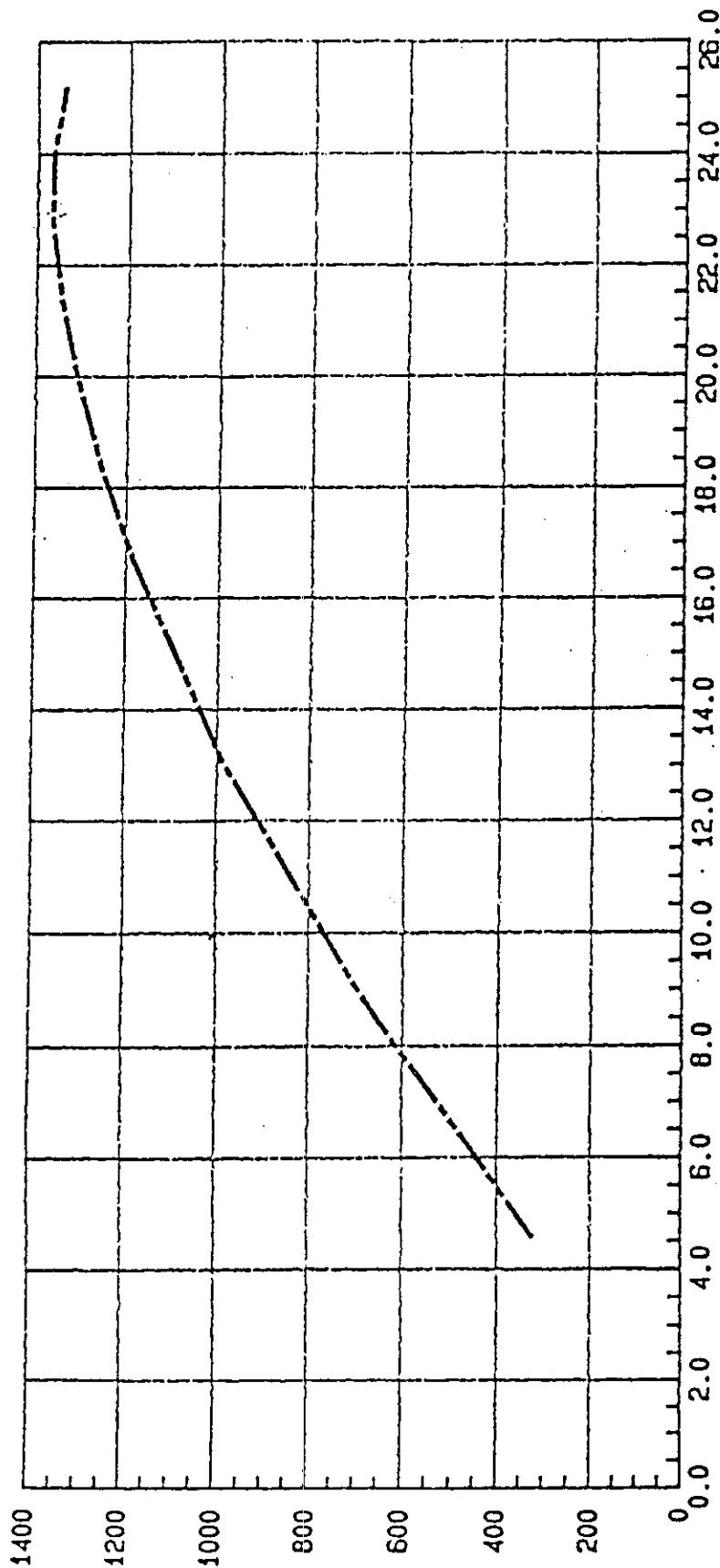
Line	Data	Standard	IUT	Type	Other	%Error
1	I	0	*-1		0-200 PSI	
2	I	100	*99.2		0-200 PSI	
3	I	195	*194.4		0-200 PSI	
4	F	0	0		0-200 PSI	
5	F	50	49.7		0-200 PSI	
6	F	100	99.8		0-200 PSI	
7	F	150	150.0		0-200 PSI	
8	F	195	195.0		0-200 PSI	

INITIAL CALIBRATION OUT OF TOLERANCE AS INDICATED BY AN(*)ASTERISK
UNIT NOW MEETS MANUFACTURERS SPECIFICATION OF ANSI GRADE "3A".

Principle procedure used: WP-26 Revision 0
Quality System based on Westcon QA Manual Revision 4, of 820626.
Laboratory temperature at certification time: 20C
Laboratory humidity at certification time: 48%RH

Data certified by: *Steven Crane*
Data certified on: 880616

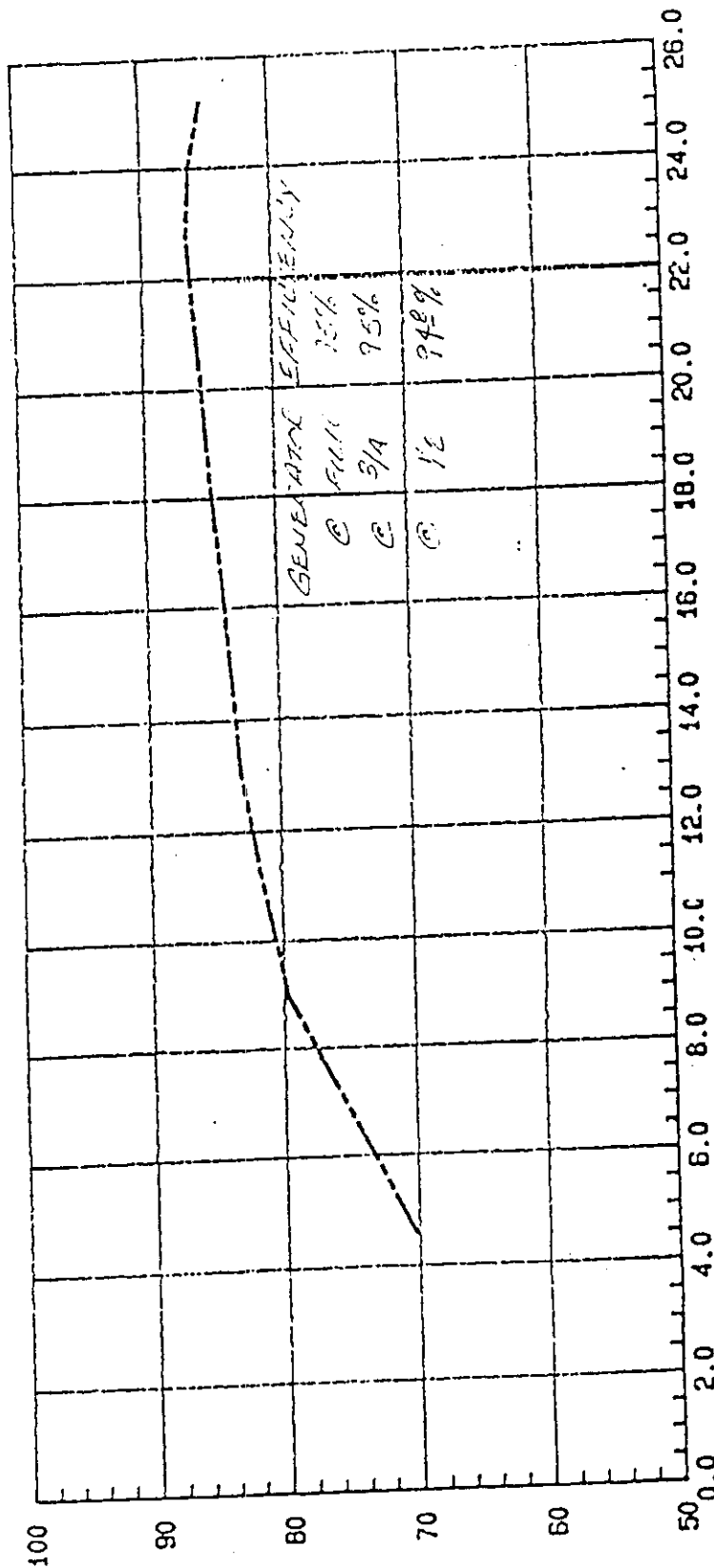
ALBERT GILKES & GORDON LTD. Kendal England	WATER TURBINE PERFORMANCE CURVE JOHN DAY CREEK HYDROELECTRIC PROJECT	Curve No: J 1147
		Date: B.8.86



General conditions set running Gross head 810 feet Net head 608 feet Flow rate 22.8 Cusecs	Turbine: High Capacity Turgo Impulse Single jet Mean Dia. 18.0 ins. Speed 1200 rpm	Our ref: 16648T/2 Your ref: Drawn: S LORD
--	---	---

108-48TD/3

BERT GILKES & GORDON LTD. Kendal England	WATER TURBINE PERFORMANCE CURVE JOHN DAY CREEK HYDROELECTRIC PROJECT		Curve No: J 1148
			Date: 8.8.86



Flow rate in Cubic feet per sec.

106457D/B

General conditions ie set running Cross head 810 feet Nett head 808 feet Flow rate 22.8 Cubecs	Turbine: High Capacity Turgo Impulse Single Jet Mean Dia. 18.0 ins. Speed 1200 rpm		Our Ref: 16648T/2
			Your Ref:
		Drawn	S LOAD

June 8, 1989

John Day Creek Performance Test Analysis

Appendix B
Regression On Test Data

OBS	FLOW	KW	SQRFLD	CUBFLD
1	0.00	0	0.000	0.0
2	0.00	0	0.000	0.0
3	0.00	0	0.000	0.0
4	0.00	0	0.000	0.0
5	0.00	0	0.000	0.0
6	0.00	0	0.000	0.0
7	0.00	0	0.000	0.0
8	0.00	0	0.000	0.0
9	0.00	0	0.000	0.0
10	0.00	0	0.000	0.0
11	0.00	0	0.000	0.0
12	0.00	0	0.000	0.0
13	0.00	0	0.000	0.0
14	0.00	0	0.000	0.0
15	0.00	0	0.000	0.0
16	0.00	0	0.000	0.0
17	0.00	0	0.000	0.0
18	0.00	0	0.000	0.0
19	0.00	0	0.000	0.0
20	0.00	0	0.000	0.0
21	0.00	0	0.000	0.0
22	0.00	0	0.000	0.0
23	0.00	0	0.000	0.0
24	0.00	0	0.000	0.0
25	0.00	0	0.000	0.0
26	0.00	0	0.000	0.0
27	0.00	0	0.000	0.0
28	0.00	0	0.000	0.0
29	0.00	0	0.000	0.0
30	0.00	0	0.000	0.0
31	0.00	0	0.000	0.0
32	0.00	0	0.000	0.0
33	0.00	0	0.000	0.0
34	0.00	0	0.000	0.0
35	0.00	0	0.000	0.0
36	0.00	0	0.000	0.0
37	0.00	0	0.000	0.0
38	0.00	0	0.000	0.0
39	0.00	0	0.000	0.0
40	0.00	0	0.000	0.0
41	4.36	218	19.010	82.9
42	8.40	422	70.560	592.7
43	11.97	568	143.281	1715.1
44	14.62	638	213.744	3124.9
45	16.65	658	277.222	4615.8
46	18.32	642	335.622	6148.6
47	19.55	620	382.202	7472.1
48	20.44	585	417.794	8539.7
49	21.14	550	446.900	9447.5
50	22.66	515	513.476	11635.4

DEP VARIABLE: KW

ANALYSIS OF VARIANCE

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB>F
MODEL	3	2507128.40	835709.47	39858.587	0.0001
ERROR	46	964.47561	20.96686118		
C TOTAL	49	2508092.88			
ROOT MSE		4.578959	R-SQUARE	0.9996	
DEP MEAN		108.32	ADJ R-SQ	0.9996	
C.V.		4.227251			

PARAMETER ESTIMATES

VARIABLE	DF	PARAMETER ESTIMATE	STANDARD ERROR	T FOR HO: PARAMETER=0	PROB > T
INTERCEP	1	-0.06349812	0.72345477	-0.088	0.9304
FLOW	1	47.93670320	1.29412561	37.042	0.0001
SQRFLO	1	1.17291799	0.15864333	7.393	0.0001
CUBFLO	1	-0.10243658	0.004773348	-21.460	0.0001

OBS	ACTUAL	PREDICT VALUE	STD ERR PREDICT	LOWER 95% PREDICT	UPPER 95% PREDICT	RESIDUAL	STD ERR RESIDUAL	STUDENT RESIDUAL	-2-1-0 1 2	COOK'S D
1	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
2	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
3	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
4	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
5	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
6	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
7	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
8	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
9	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
10	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
11	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
12	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
13	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
14	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
15	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
16	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
17	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
18	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
19	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
20	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
21	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000
22	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140		0.000

OBS	ACTUAL	PREDICT VALUE	STD ERR PREDICT	LOWER95% PREDICT	UPPER95% PREDICT	RESIDUAL	STD ERR RESIDUAL	STUDENT RESIDUAL	-2-1-0 1 2	COOK'S D
23	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
24	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
25	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
26	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
27	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
28	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
29	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
30	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
31	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
32	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
33	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
34	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
35	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
36	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
37	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
38	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
39	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
40	0	-0.0635	0.7235	-9.3948	9.2678	0.0635	4.5214	0.0140	1	0.000
41	218.0	222.7	3.0677	211.7	233.8	-4.7471	3.3994	-1.3965	**	0.397
42	422.0	424.7	2.9122	413.7	435.6	-2.6513	3.5335	-0.7503	*	0.096
43	568.0	566.1	2.2925	555.8	576.4	1.8906	3.9638	0.4770	***	0.228
44	638.0	631.4	2.2745	621.1	649.7	6.6327	3.9741	1.6690	***	0.294
45	658.0	650.4	2.2655	640.1	660.7	7.5802	3.9792	1.9049	***	0.000
46	642.0	642.0	2.0725	631.8	652.1	0.0473	4.0831	0.0116	1	0.000
47	620.0	620.0	1.8973	610.0	630.0	0.0209	4.1674	0.050124	1	0.000
48	585.0	595.0	1.9327	585.0	605.0	-10.0226	4.1511	-2.4145	****	0.316
49	550.0	569.7	2.1883	559.5	579.9	-19.7298	4.0222	-4.9052	*****	1.780
50	515.0	496.6	3.6138	484.8	508.3	18.4392	2.8120	6.5574	*****	17.755

SUM OF RESIDUALS -2.59348E-13
SUM OF SQUARED RESIDUALS 964.4756
PREDICTED RESID SS (PRESS) 3471.999

OBS	RESIDUAL	RSTUDENT	HAT DIAG H	COV RATIO	OFFITS	INTERCEP DFBETAS	FLOW DFBETAS	SQRFLD DFBETAS	CUBFLD DFBETAS
1	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
2	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
3	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
4	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
5	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
6	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
7	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
8	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
9	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002

OBS	RESIDUAL	RSTUDENT	HAT DIAG H	COV RATIO	OFFITS	INTERCEP DFBETAS	FLOW DFBETAS	SQRFLD DFBETAS	CUBFLD DFBETAS
10	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
11	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
12	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
13	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
14	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
15	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
16	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
17	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
18	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
19	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
20	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
21	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
22	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
23	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
24	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
25	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
26	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
27	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
28	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
29	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
30	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
31	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
32	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
33	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
34	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
35	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
36	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
37	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
38	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
39	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
40	0.0635	0.0139	0.0250	1.1198	0.0022	0.0022	-0.0003	0.0002	-0.0002
41	-4.7471	-1.4114	0.4489	1.6659	-1.2737	-0.0528	-1.2311	1.1616	-1.0776
42	-2.6513	-0.7467	0.4045	1.7454	-0.6154	0.0142	-0.5263	0.4461	-0.3801
43	1.8906	0.4729	0.2507	1.4285	0.2735	-0.0077	0.1014	-0.0432	0.0053
44	6.6327	1.7031	0.2467	1.1291	0.9747	-0.0071	-0.1543	0.3566	-0.4659
45	7.5802	1.9631	0.2448	1.0408	1.1177	0.0099	-0.4618	0.6499	-0.7310
46	0.0473	0.0115	0.2049	1.3732	0.0058	0.0001	-0.0028	0.0035	-0.0037
47	0.0209	0.0050	0.1717	1.3182	0.0023	0.0000	-0.0009	0.0010	-0.0010
48	-10.0226	-2.5555	0.1782	0.7727	-1.1898	-0.0137	0.2272	-0.2124	0.1417
49	-19.7298	-7.0251	0.2284	0.0732	-3.8219	-0.0108	-0.1054	0.3473	-0.6673
50	18.4392	25.3960	0.6229	0.0001	32.6381	-0.4844	12.9246	-16.8556	20.0278

John Day Creek Hydroelectric Project
Generation Estimate of Actual Project Performance
Average Water Conditions

Month	Flow (cfs)	Bypass (cfs)	Flow Available For Generation (cfs)	Estimated Output Using Actual Performance (kW)	Generation (kWh)
Jan	11.5	4.5	7.0	358	65,304
Jan	12.0	4.5	7.5	382	69,756
Jan	14.0	4.5	9.5	473	86,389
Jan	14.0	4.5	9.5	473	86,389
Feb	13.5	4.5	9.0	452	82,435
Feb	13.0	4.5	8.5	429	78,335
Feb	13.5	4.5	9.0	452	82,435
Feb	13.5	4.5	9.0	452	82,435
Mar	13.5	4.5	9.0	452	82,435
Mar	14.0	4.5	9.5	473	86,389
Mar	16.0	4.5	11.5	551	100,472
Mar	16.5	4.5	12.0	567	103,490
Apr	18.5	4.5	14.0	620	113,124
Apr	21.0	4.5	16.5	650	118,636
Apr	24.0	12.0	12.0	567	103,490
Apr	26.0	12.0	14.0	620	113,124
May	29.0	12.0	17.0	651	118,739
May	35.0	12.0	23.0	651	118,739
May	40.0	12.0	28.0	651	118,739
May	44.0	12.0	32.0	651	118,739
Jun	47.0	12.0	35.0	651	118,739
Jun	50.0	12.0	38.0	651	118,739
Jun	50.0	12.0	38.0	651	118,739
Jun	43.0	12.0	31.0	651	118,739
Jul	38.0	12.0	26.0	651	118,739
Jul	32.0	12.0	20.0	651	118,739
Jul	27.0	4.5	22.5	651	118,739
Jul	25.0	4.5	20.5	651	118,739
Aug	24.0	4.5	19.5	651	118,739
Aug	20.0	4.5	15.5	643	117,400
Aug	17.5	4.5	13.0	596	108,822
Aug	16.0	4.5	11.5	551	100,472
Sep	15.0	4.5	10.5	514	93,806
Sep	15.0	4.5	10.5	514	93,806
Sep	15.0	4.5	10.5	514	93,806
Sep	15.0	4.5	10.5	514	93,806
Oct	13.0	4.5	8.5	429	78,335
Oct	14.0	4.5	9.5	473	86,389
Oct	13.0	4.5	8.5	429	78,335
Oct	13.0	4.5	8.5	429	78,335
Nov	13.0	4.5	8.5	429	78,335
Nov	13.0	4.5	8.5	429	78,335
Nov	13.0	4.5	8.5	429	78,335
Nov	14.0	4.5	9.5	473	86,389
Dec	14.0	4.5	9.5	473	86,389
Dec	12.5	4.5	8.0	406	74,104
Dec	12.5	4.5	8.0	406	74,104
Dec	13.0	4.5	8.5	429	78,335
Total					4,655,873

John Day Creek Performance Test Analysis

Appendix C
Generation Estimates Under Historical Average Water
Conditions

John Day Creek Hydroelectric Project
Generation Estimate of Actual Project Performance
Average Water Conditions

Month	Monthly Total Generation (kWh)
Jan	307,838
Feb	325,639
Mar	372,786
Apr	448,373
May	474,954
Jun	474,954
Jul	474,954
Aug	445,433
Sep	375,222
Oct	321,394
Nov	321,394
Dec	312,932
Total	4,655,873

Season	Seasonal Total Generation (kWh)
Jul-Oct	1,617,003
Nov-Feb	1,267,803
Mar-Jun	1,771,067
Total	4,655,873

June 8, 1989

John Day Creek Performance Test Analysis

Appendix D
Preconstruction Generation Estimates

JOHN DAY HYDROELECTRIC PROJECT
---CURRENT PROJECT---

10-Jul-86

TURBINE - 15" HIGH CAPACITY TURGO IMPULSE - SINGLE JET

HEAD 910 FT.
LENGTH 13150 FT.
PENSTOCK DIA. 18"

MONTH	FLOW	BYPASS	POWER	TOTAL CFS DOWNSTRM.	VEL. (FT./S)	HEAD LOSS	NET HEAD	THEORY KW	ACTUAL KW	KWH
JAN	11.5	4.5	7.0	4.5	3.96	33.6	876.4	519	383	69953
JAN	12.0	4.5	7.5	4.5	4.24	38.2	871.8	554	413	75386
JAN	14.0	4.5	9.5	4.5	5.38	59.2	850.8	684	525	95807
JAN	14.0	4.5	9.5	4.5	5.38	59.2	850.8	684	525	95807
FEB	13.5	4.5	9.0	4.5	5.09	53.6	856.4	653	499	91149
FEB	13.0	4.5	8.5	4.5	4.81	48.2	861.8	620	473	86368
FEB	13.5	4.5	9.0	4.5	5.09	53.6	856.4	653	499	91149
FEB	13.5	4.5	9.0	4.5	5.09	53.6	856.4	653	499	91149
MAR	13.5	4.5	9.0	4.5	5.09	53.6	856.4	653	499	91149
MAR	14.0	4.5	9.5	4.5	5.38	59.2	850.8	684	525	95807
MAR	16.0	4.5	11.5	4.5	6.51	84.3	825.7	804	623	113621
MAR	16.5	4.5	12.0	4.5	6.77	91.2	818.8	832	679	123842
APR	18.5	4.5	14.0	4.5	7.92	121.4	788.6	935	769	140394
APR	21.0	4.5	16.5	4.5	9.34	164.5	745.5	1041	857	156396
APR	24.0	12.0	12.0	12.0	6.79	91.2	818.8	832	679	123842
APR	26.0	12.0	14.0	12.0	7.92	121.4	788.6	935	769	140394
MAY	29.0	12.0	17.0	12.0	9.62	173.9	736.1	1060	872	159114
MAY	35.0	12.0	20.0	15.0	11.32	235.0	675.0	1143	917	167386
MAY	40.0	12.0	20.0	20.0	11.32	235.0	675.0	1143	917	167386
MAY	44.0	12.0	20.0	24.0	11.32	235.0	675.0	1143	917	167386
JUN	47.0	12.0	20.0	27.0	11.32	235.0	675.0	1143	917	167386
JUN	50.0	12.0	20.0	30.0	11.32	235.0	675.0	1143	917	167386
JUN	50.0	12.0	20.0	30.0	11.32	235.0	675.0	1143	917	167386
JUN	43.0	12.0	20.0	23.0	11.32	235.0	675.0	1143	917	167386
JUL	38.0	12.0	20.0	18.0	11.32	235.0	675.0	1143	917	167386
JUL	32.0	12.0	20.0	12.0	11.32	235.0	675.0	1143	917	167386
JUL	27.0	4.5	20.0	7.0	11.32	235.0	675.0	1143	917	167386
JUL	25.0	4.5	20.0	5.0	11.32	235.0	675.0	1143	917	167386
AUG	24.0	4.5	19.5	4.5	11.03	224.2	685.8	1132	914	166794
AUG	20.0	4.5	15.5	4.5	8.77	146.6	763.4	1002	824	150463
AUG	17.5	4.5	13.0	4.5	7.36	105.8	804.2	895	725	132390
AUG	16.0	4.5	11.5	4.5	6.51	84.3	825.7	804	623	113621
SEP	15.0	4.5	10.5	4.5	5.94	71.2	838.8	746	577	105384
SEP	15.0	4.5	10.5	4.5	5.94	71.2	838.8	746	577	105384
SEP	15.0	4.5	10.5	4.5	5.94	71.2	838.8	746	577	105384
SEP	15.0	4.5	10.5	4.5	5.94	71.2	838.8	746	577	105384
OCT	13.0	4.5	8.5	4.5	4.81	48.2	861.8	620	473	86368
OCT	14.0	4.5	9.5	4.5	5.38	59.2	850.8	684	525	95807
OCT	13.0	4.5	8.5	4.5	4.81	48.2	861.8	620	473	86368
OCT	13.0	4.5	8.5	4.5	4.81	48.2	861.8	620	473	86368
NOV	13.0	4.5	8.5	4.5	4.81	48.2	861.8	620	473	86368
NOV	13.0	4.5	8.5	4.5	4.81	48.2	861.8	620	473	86368
NOV	13.0	4.5	8.5	4.5	4.81	48.2	861.8	620	473	86368
NOV	14.0	4.5	9.5	4.5	5.38	59.2	850.8	684	525	95807
DEC	14.0	4.5	9.5	4.5	5.38	59.2	850.8	684	525	95807
DEC	12.5	4.5	8.0	4.5	4.53	43.1	866.9	587	443	80843
DEC	12.5	4.5	8.0	4.5	4.53	43.1	866.9	587	443	80843
DEC	13.0	4.5	8.5	4.5	4.81	48.2	861.8	620	473	86368

PEAK KW - 917

TOTAL KWH----- 5721049

JUL-OCT ----- 2009261

NOV-FEB ----- 1395543

MAR-JUNE ----- 2316245