YOUGHIOGHENY RIVER TEMPERATURE

ENHANCEMENT PROTOCOL:

RESULTS FOR 2010

Prepared for

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FOREWORD

This report, Youghiogheny River Temperature Enhancement Protocol: Results for 2010, was prepared by Stephen Schreiner and Jodi Dew-Baxter, Versar, Inc., for Maryland Department of Natural Resources Power Plant Research Program. This work was supported by Contract No. K00B1400005.

ABSTRACT

During the period of June 1 through August 31, 2010, releases were made from Deep Creek Hydroelectric Station on 75 days, or 82% of the time. Releases for temperature enhancement were made on 33 days, or 36% of all releases. Scheduled and announced releases (either for whitewater recreation or power generation) occurred 38 times, or 41% of all releases. Water temperatures exceeded the target of 25°C at Sang Run on a total of 16 days, and the maximum temperature was 26.1°C. Temperature also exceeded the target level at Swallow Falls 52 times, at the confluence of Deep Creek with the river 35 times, above the tailrace 19 times, between Hoyes Run and Steep Run 9 times, and at Steep Run 10 times. One of the exceedances at Sang Run was due to flow being greater than 150 cfs; 12 were due to model/protocol uncertainty, and 3 were due to operator error in failing to use the correct cloud cover factor in the model protocol.

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1.0 INTRODUCTION

Schreiner et al. (2009) described the temperature enhancement protocol for predicting maximum daily water temperature in the Youghiogheny River during summer using daily measurements of river flow and temperature changes in the river and available predictions of maximum daily air temperature and cloud cover in the region of the Deep Creek project. The goals of the protocol are to (1) operate the Deep Creek Hydroelectric Station (DCHS), as necessary, to prevent water temperatures from exceeding 25°C in the Youghiogheny River between the tailrace and Sang Run; (2) minimize unnecessary releases for temperature enhancement; (3) provide maximum advance notice of releases to those interested in whitewater recreation; and (4) provide simple, automated implementation. The protocol consists of a series of equations (developed using multiple regression models) to be used by DCHS operators during the morning and early afternoon to predict river temperature. The operators use those predictions to determine whether a release is needed to enhance temperature. The public is then notified of those releases via a telephone recording. This report presents results of the 16th year (summer 2010) following formal implementation of the protocol.

2.0 RESULTS

2.1 METHODS

Data were obtained from various sources and summarized for use in evaluating the temperature enhancement protocol for 2010. Appendix A presents the summarized data in a table, and Appendix B presents graphs for each day for which data were available during the temperature enhancement period. Appendix C discusses factors affecting Deep Creek Lake water elevation levels. The sources of the different data types used are described below.

2.1.1 Water Temperature

Station operators recorded water temperatures at the Sang Run bridge at 10-minute intervals from June through August, 2010. Operators used these real-time data in deciding whether to release water for temperature enhancement according to the protocol. The 10-minute data were subset at half-hour intervals for comparison with data collected by Maryland Department of Natural Resources (DNR) Fisheries Service using StowAway TidbiT temperature loggers (DNR temperature loggers) placed at the following locations in the Youghiogheny River (Figure 2-1): Swallow Falls; at the confluence of Deep Creek with the river; above the tailrace; in the tailrace; Hoyes Run; between Hoyes Run and Steep Run; Steep Run, between Steep Run and Sang Run; and Sang Run (two recorders). The DNR temperature loggers recorded temperatures at half-hour intervals from June 16 through August 31, 2010. Data from DNR's Sang Run station (DNR Sang Run logger) and the temperature logger maintained by the power company (DCHS Sang Run logger) were plotted daily for comparison with operation of the power station, and flow and meteorological data (Appendix B).

To be consistent with the protocol analyses of previous years, we used data from the DNR Sang Run logger to determine if water temperature in the river exceeded the target temperature of 25°C. The DNR Sang Run logger recorded 16 exceedances, and the DCHS Sang Run logger recorded 19 exceedances between June 1 and August 31, 2010. We used data from the Swallow Falls temperature logger as an estimate of what the river temperature at Sang Run would have been without releases from DCHS.

2.1.2 Meteorological Data

Station operators used forecasted information from Elkins, WV, as part of the temperature enhancement protocol. This information was used on days in June through August when no releases were scheduled for other purposes to determine if a temperature release would be needed on those days. Hourly records of actual meteorological data from

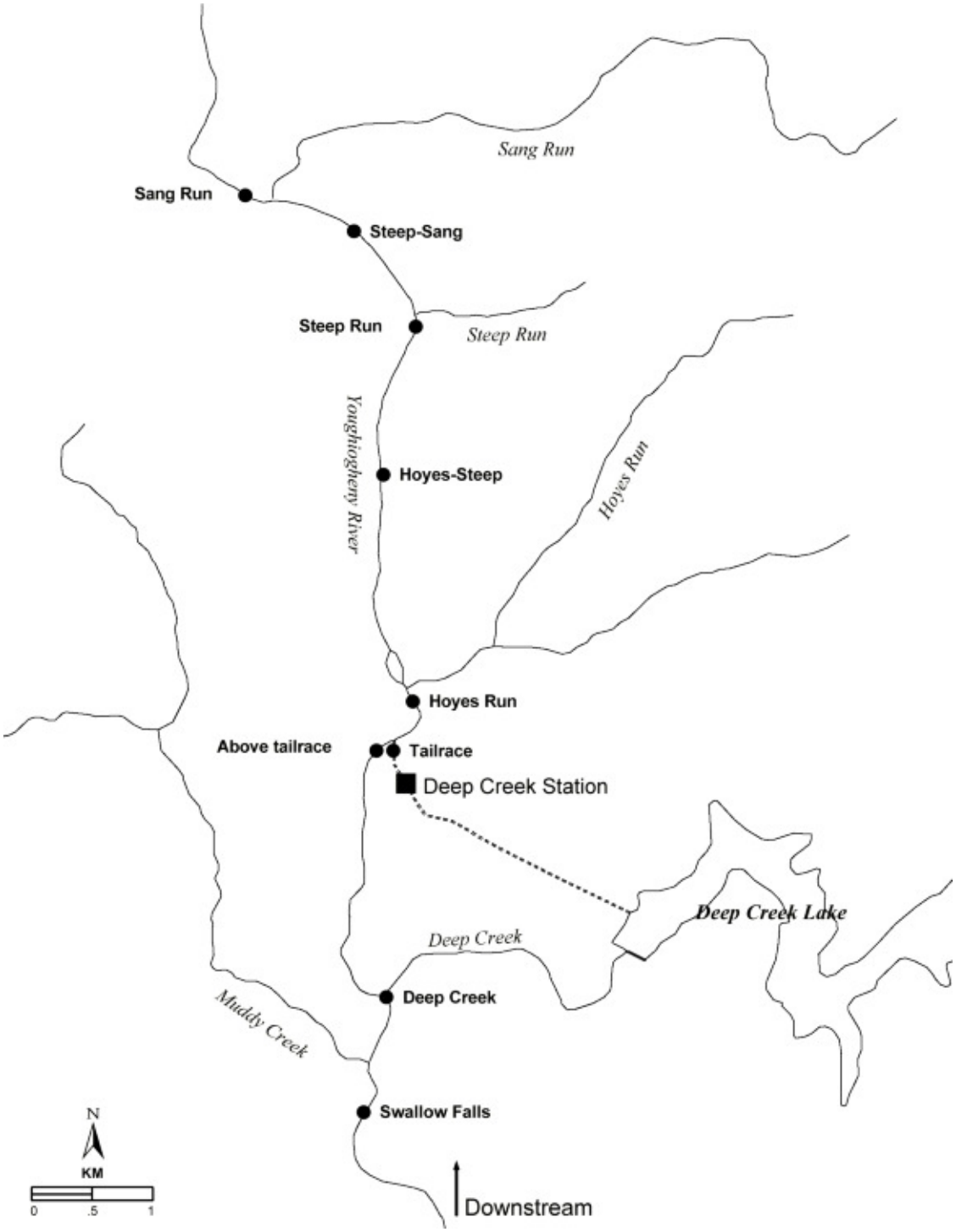

Figure 2-1. Map of the Youghiogheny River between Swallow Falls and Sang Run, MD, showing the location of Deep Creek Station tailrace, temperature logger stations, and major tributaries

the Elkins station were obtained from the National Climatic Data Center after the summer season. Elkins data were used to obtain average daytime values for actual cloud cover and daily minimum and maximum air temperatures for comparison with predicted values. Daily minimum and maximum air temperatures for Oakland, MD were also used for comparison. Cloud-cover fraction was reported using terms describing sky cover. Those descriptive terms were converted to an average numerical value on the same scale as the other numerical data as follows: CLR or FEW = 0.5; SCT = 3; BKN = 7.5; OVC = 9.5. Those values were used for analyses that required measured cloud-cover fractions. Station operators were expected to use descriptions of predicted cloud cover as the basis for selecting the numerical values, as described in the revised temperature enhancement protocol.

2.1.3 River Flow Data

Station operators obtained nearly instantaneous (with about a 4-hour delay), early morning flow readings for the Youghiogheny River at Oakland from the USGS gage (Internet address: http://waterdata.usgs.gov/md/nwis/current/?type=flow). For the analysis presented here, we obtained flow information recorded at hourly intervals from the USGS gage (station number 03075500) and summarized it to provide daily averages. The hourly data were plotted with temperature measurements to indicate changes in flow that may have occurred throughout each 24-hour period because of storms (Appendix B). Average flow for June through August, 2010, was 115 cfs, which is lower than the long-term median summer flow of 170 cfs (Table 2-1). The summer of 2010 was ranked 23 out of 69 on a hydrologic ranking of summer average flow at Oakland since 1942. August 2010 was the second driest in the last 15 years.

Table 2-1. Hydrologic ranking of summer average flow (cfs) at Oakland from 1942 through 2010 (USGS station 03075500)

Year	Rank	June	July	August	Average
1995	18	111	37	116	88
1996	67	273	567	362	401
1997	39	240	75	150	155
1998	53	417	205	78	231
1999	3	23	20	14	19
2000	46	254	257	75	195
2001	57	273	438	115	296
2002	15	38	145	41	84
2003	69	766	539	358	554
2004	43	368	58	110	176
2005	36	101	290	54	149
2006	30	238	125	23	127
2007	40	44	159	284	160
2008	48	343	301	75	205
2009	28	285	48	49	125
2010	**23**	**284**	**48**	**19**	**115**
Average		214	170	128	170

2.2 RESULTS AND DISCUSSION

Table 2-2 summarizes the releases from DCHS between June 1 and August 31, 2010. The table shows that announced and scheduled whitewater releases occurred on 36% of the total days during this period [Mondays, Fridays, and Saturdays as per the DCHS Water Appropriations and Use Permit GA1992S009(07), when water levels were above the lower rule band]. Tabulation of scheduled whitewater releases included all Mondays and Fridays, and Saturdays and other days previously scheduled as whitewater boating days. There were 5 announced and scheduled releases for power generation (5% of total days). Unscheduled releases occurred on 40% of the total days, consisting of 36% for temperature enhancement and 4% for unscheduled power generation (generation of 15 minutes or less is not included in this calculation).

Table 2-2. Summary of releases from DCHS in 2010 during implementation of the temperature enhancement protocol (June 1 through August 31)

Release Type	# Days (6/1-8/31)	% Days (6/1-8/31)
Announced and Scheduled for WW	33	36%
Announced and Scheduled for Power	5	5%
TOTAL announced and scheduled	**38**	41%
Not Announced or Scheduled (Power)	4	4%
Temperature Enhancement	33	36%
TOTAL unscheduled	**37**	40%
Days with no release	17	18%
TOTAL Days	**92**	100%

Figure 2-2 is a summary of releases for all years since 1995, when the temperature-enhancement protocol began. The number of power releases in 2010 was smaller than in 2009, but the number of temperature enhancement releases was greater than in 2009. The total number of days with releases in 2010 was greater than in all years except 1995 and 1996.

On 7 dates, DCHS listed a temperature release following a whitewater release. These additional releases (not included in Figure 2-2) appear to be the result of a new section in the temperature enhancement protocol revised in January 2009. That section states *"On days of scheduled releases for whitewater events as outlined in condition 19 of the permit (GA 1992S009(07)), the permittee shall have the discretion [to] begin a release up to one (1) hour earlier than the scheduled release time, if the protocol evaluation predicts a need for a temperature enhancement release."* Previously, this section stated *"A scheduled release commencing no later than 1100 hours and continuing to at least 1300 hours will negate the need to implement the Water Temperature Enhancement Protocol (or Contingency Protocol."* These releases resulted in an additional 5.5 hours of releases that were not necessary for temperature enhancement. Although the revised language was proposed by the power

company, Brookfield appears to interpret it as requiring them to run the temperature protocol on whitewater release days and to make additional releases when the protocol requires it. However, the protocol as currently implemented does not account for the cooling effect of whitewater releases and therefore should not be used once a whitewater release has started, as the cooling effect of these releases will be sufficient for temperature enhancement purposes. We recommend the protocol be changed to the previous language for this section to avoid confusion on this issue in the future.

Table 2-3 lists the dates when temperature exceeded 25°C, the duration of the exceedance, the maximum temperature for each date, and the probable reason for the exceedance. The DNR and DCHS Sang Run loggers recorded 16 such exceedances in 2010. One exceedance was due to the flow being greater than 150 cfs, and 12 were due to model/protocol uncertainty. Three exceedances were due to operator error when DCHS operators incorrectly used cloud-cover factors for thunderstorms and showers. An additional 3 exceedances occurred at the DCHS Sang Run logger but not at the DNR Sang Run logger for the reasons indicated in the table. Schreiner et al. (2006) recommended revising the cloud-cover factor values for thunderstorms and showers. These cloud forecast descriptions had been given cloud-cover factor values of 100 and 64, respectively, in the original DCHS protocol software, and those values were shown to be inaccurate for predicting the timing of maximum river temperatures. The revised and approved temperature enhancement protocol included the corrected cloud-cover factor values, but these apparently were not implemented in the protocol software for 2010.

Table 2-4 illustrates the frequency distribution of river temperatures greater than 25°C at Sang Run (based on the DNR Sang Run logger) compared with temperatures at the Swallow Falls station to represent temperature at Sang Run without releases from DCHS. This table shows 16 days on which temperatures were greater than 25°C at Sang Run; the maximum temperature was 26.1°C. Without releases from DCHS, temperatures could have exceeded 25°C on 52 days, and the maximum temperature would have been 29.6°C.

Figure 2-3 shows the number of exceedances by temperature ranges from the start of the temperature enhancement protocol in 1995 to 2010 for Sang Run. The number of exceedances this year is greater than in 2009, and the data show an increased number of exceedances in the 25.1°C to 25.5°C range and 25.6°C to 26.0°C range, however no exceedances in the 26.6-27.0°C range.

Figures 2-4 through 2-9 show the maximum daily temperatures (based on the DNR temperature loggers) in 2010 at all the monitored stations. These figures show maximum temperatures at the Swallow Falls station, the confluence of the Deep Creek tributary, and above the tailrace; these three stations are unaffected by releases from DCHS. The figures also show temperatures immediately downstream and at five locations between the Tailrace and Sang Run. The figures illustrate that river temperatures exceeded 25°C at Swallow Falls on 52 days, at Deep Creek on 35 days, and above the tailrace on 19 days. Of the five downstream stations, Hoyes is located closest to the tailrace, and water temperature did not exceed 25°C there. Temperatures did not exceed the target level at Steep-Sang Run but did exceed the target level at Hoyes-Steep 9 times and at Steep Run 10 times. Temperature exceeded 25°C at Sang Run 16 times.

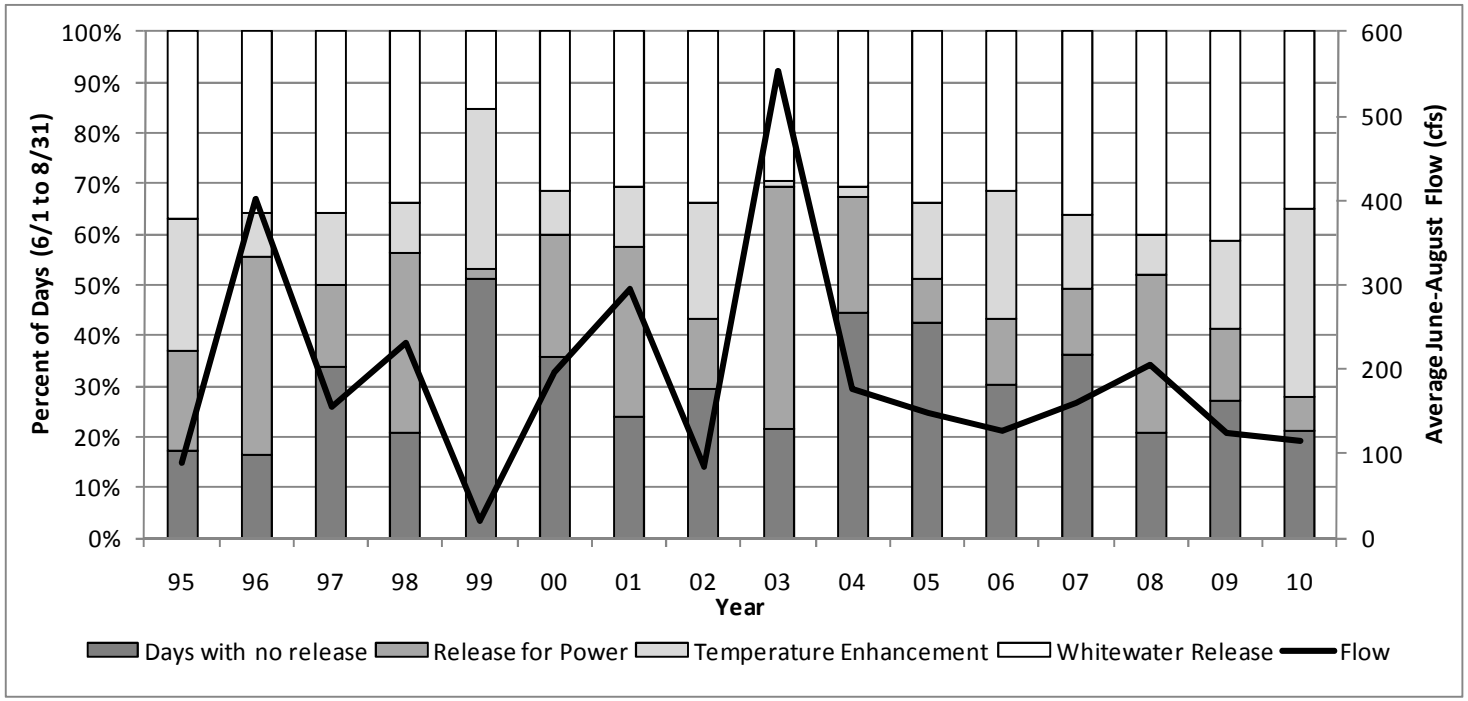

Figure 2-2. Percent of days with various kinds of releases, or no release, from DCHS from June 1 through August 31, 1995-2010; and summer average flow (cfs, June through August).

Table 2-3. Summary of temperatures exceeding 25°C in the Youghiogheny River at Sang Run between June 1 and August 31, 2010. Start Time Variables: A=using approved protocol as shown in power company log file; A (calculated) = approved protocol variables recalculated as a QA check; A (revised CCF)= protocol with revision of cloud cover factor (36) for thunder storms and showers; B=use actual max air temp with predicted cloud cover; C=use actual cloud cover with predicted air temp; D=use actual cloud cover and actual air temp; E=use DNR Sang Run logger data with forecasted variables; F=use DNR Sang Run logger data and actual cloud cover and actual air temp

Date	Duration of exceed-ance (hours)	Time of exceed-ance	Max Temp (°C) DNR	Max Temp (°C) DCHS	Actual start time of release	A (Log file)	A (calcu-lated)	A (correct CCF)	B	C	D	E	F	Duration of release	Reasons for exceedance
1. Exceedances with no release made for temperature enhancement [none]															
7/14/2010	1.5	16:00	25.4	26.1											Flow greater than 150 cfs
2. Release made but insufficient or not in time															
6/27/2010	1.5	13:30	25.8	29.7	12:45	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	2	Model - Protocol Uncertainty
6/30/2010	0.5	15:30	25.1	25.5	14:00	14.5	14	14	14	14	14	14	14	1.25	Model - Protocol Uncertainty
7/7/2010	0.5	13:00	25.9	25.2	11:00	11	11	11	11	11	11	11	11	2.25	Model - Protocol Uncertainty
7/8/2010	0.5	13:00	25.5	25.3	11:00	11	11	11	11	11	11	11	11	4.5	Model - Protocol Uncertainty
7/11/2010	0.5	14:30	26.0	25.8	11:30	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	3	Model - Protocol Uncertainty
7/15/2010	1.5	13:30	25.5	25.7	12:30	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	2.25	Model - Protocol Uncertainty
7/20/2010	2.5	12:30	26.1	26.0	12:30	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	2	Model - Protocol Uncertainty
7/21/2010	0.5	16:30	25.2	26.2	13:00	15.5	15	12.5	15	15	15			1	Operator Error (wrong CCF)
7/22/2010	0.5	13:00	25.7	25.5	11:00	11	11	11	11			11	11	2	Model - Protocol Uncertainty
7/23/2010	0.5	13:00	25.7	25.8	11:00	11	11	11	11	11	11	11	11	3	Model - Protocol Uncertainty
7/24/2010	1	12:30	26.1	26.2	11:00	11	11	11	11	11	11	11	11	5	Model - Protocol Uncertainty
7/25/2010	0.5	13:00	25.8	25.6	11:00	11	11	11	11	11	11	11	11	2	Model - Protocol Uncertainty
7/26/2010	0.5	13:00	25.8	25.1	11:00	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	4	Model - Protocol Uncertainty
7/28/2010	1	14:00	26.0	26.3	12:30	12.5	12.5	11	11	12.5	11	12.5	12.5	2.25	Operator Error (wrong CCF)
8/15/2010	0.5	14:30	25.2	26.4	12:45	12.5	12.5	11	12.5	12.5	11	12	12.5	2	Operator Error (wrong CCF)
3. Exceedance at Power Company Temperature Logger but not at DNR Logger															
6/2/2010				25.6	13:00									5	
7/16/2010			24.5	29.4	11:00	11	11	11		11	11	11	11	3.25	
8/1/2010			24.5	25.7				11							

Table 2-4. Distribution of temperatures greater than 25°C in the Youghiogheny River at Sang Run and Swallow Falls between June 17 and August 31, 2010.		
Temperature Range	**Sang Run, Days > 25 °C**	**Swallow Falls, Days > 25 °C**
25.1 - 25.5	6	10
25.6 - 26.0	8	2
26.1- 26.5	2	10
26.6 - 27.0	0	5
27.1 - 27.5	0	8
> 27.6	0	17
Total	16	52

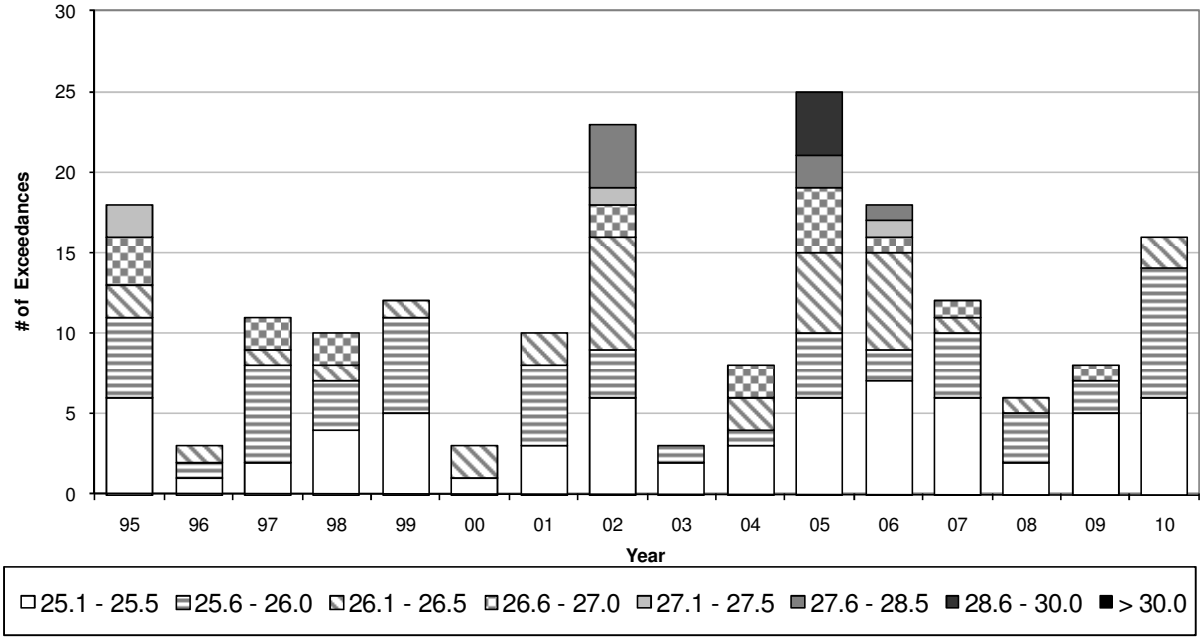

Figure 2-3. Distribution of temperatures greater than 25°C in the Youghiogheny River at Sang Run from 1995-2010.

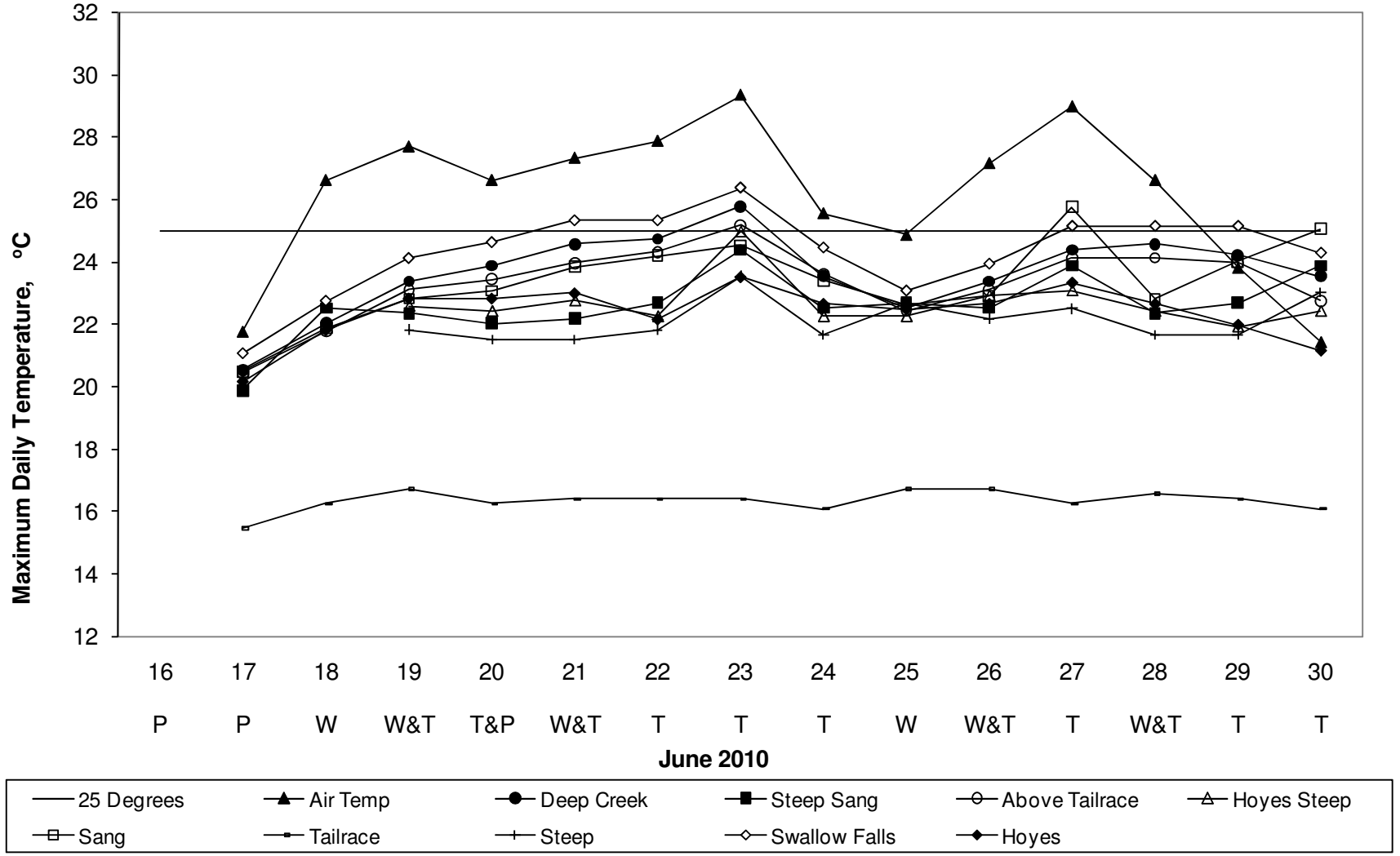

Figure 2-4. Maximum daily water temperature at several locations in the Youghiogheny River, June 16 - 30, 2010. Below each date is a code listing the primary type of release; W = whitewater; T = temperature enhancement; P = power; N = none.

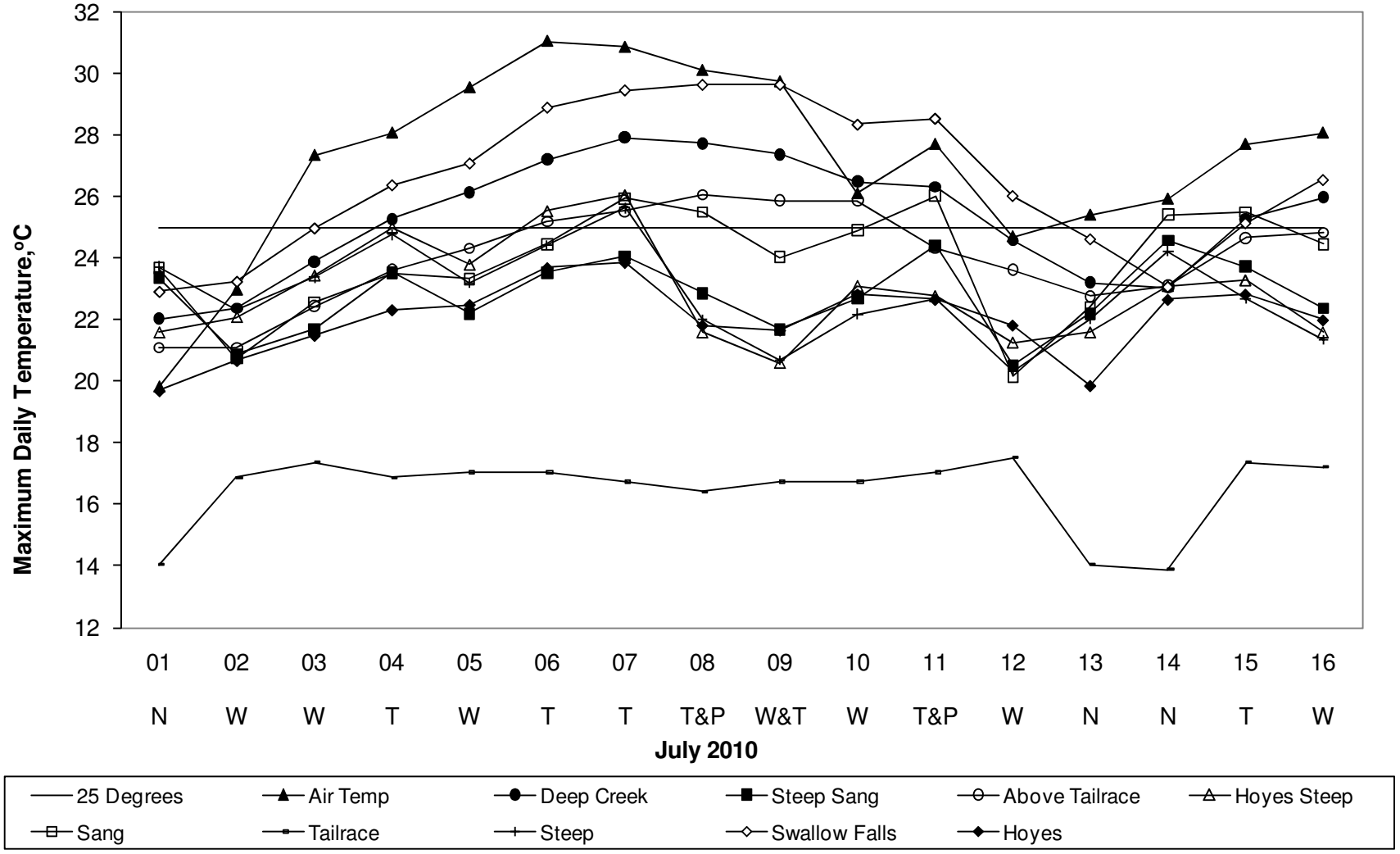

Figure 2-5. Maximum daily water temperature at several locations in the Youghiogheny River, July 1 - 16, 2010. Below each date is a code listing the primary type of release; W = whitewater; T = temperature enhancement; P = power; N = none.

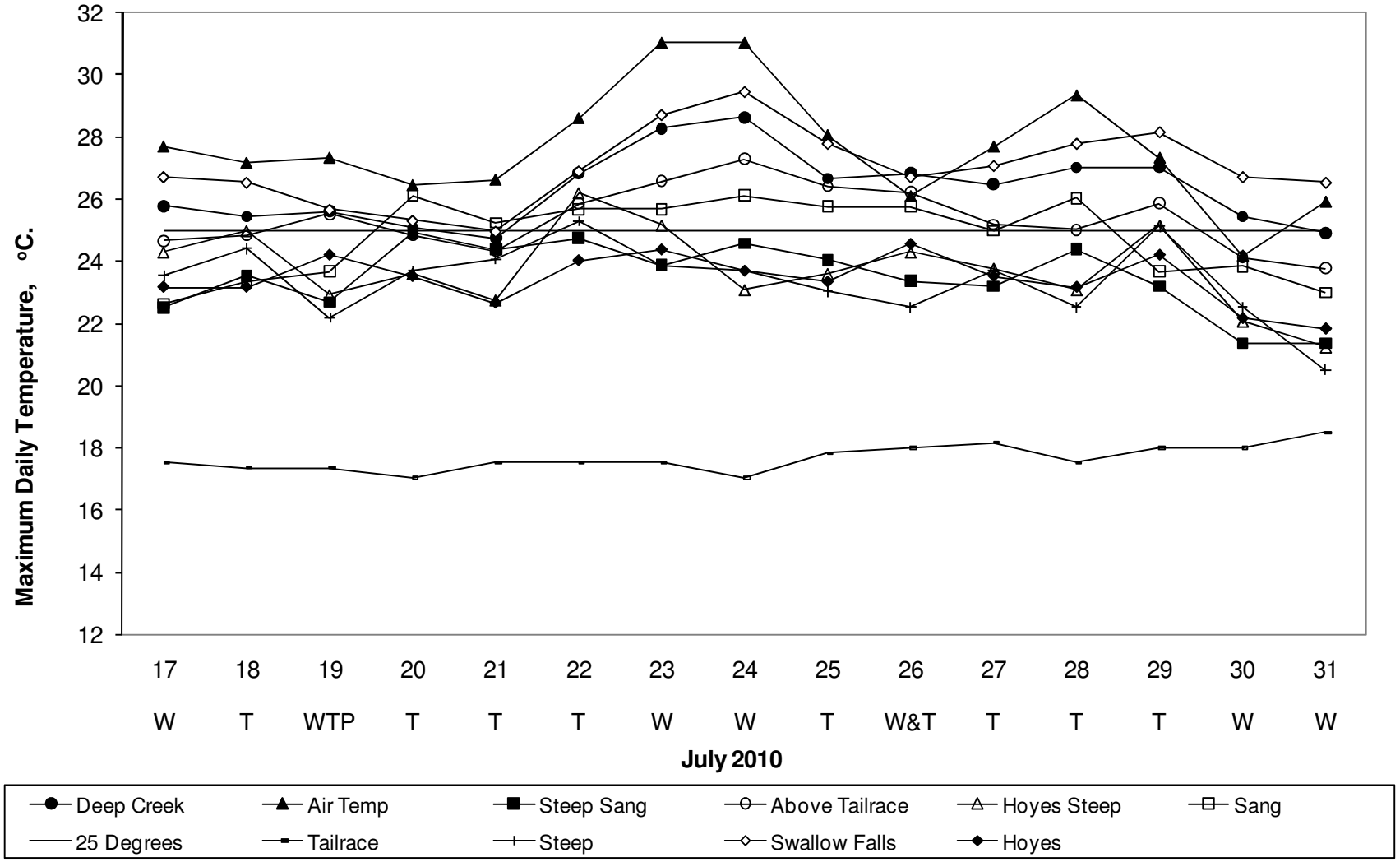

Figure 2-6. Maximum daily water temperature at several locations in the Youghiogheny River, July 17 - 31, 2010. Below each date is a code listing the primary type of release; W = whitewater; T = temperature enhancement; P = power; N = none.

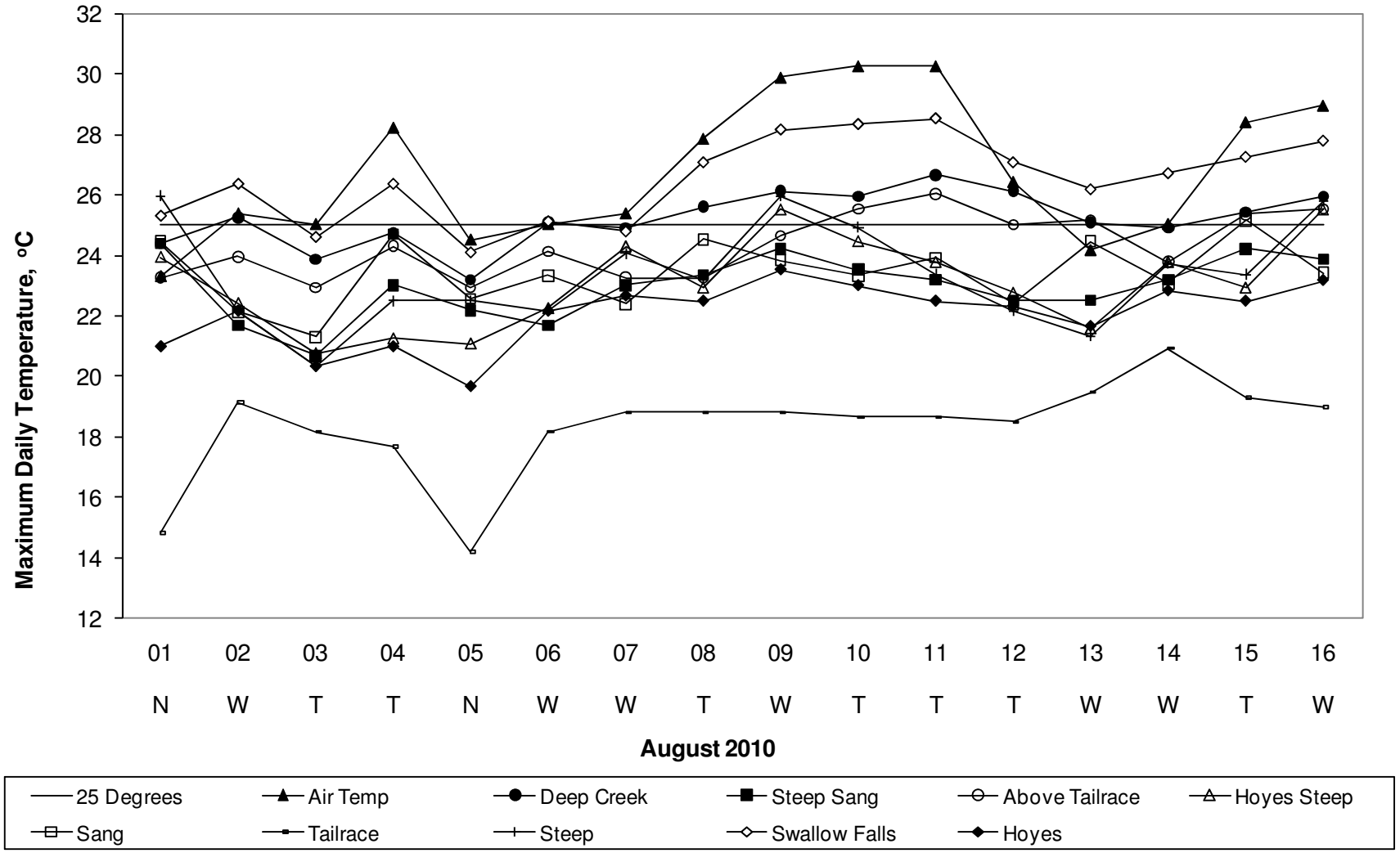

Figure 2-7. Maximum daily water temperature at several locations in the Youghiogheny River, August 1 - 16, 2010. Below each date is a code listing the primary type of release; W = whitewater; T = temperature enhancement; P = power; N = none.

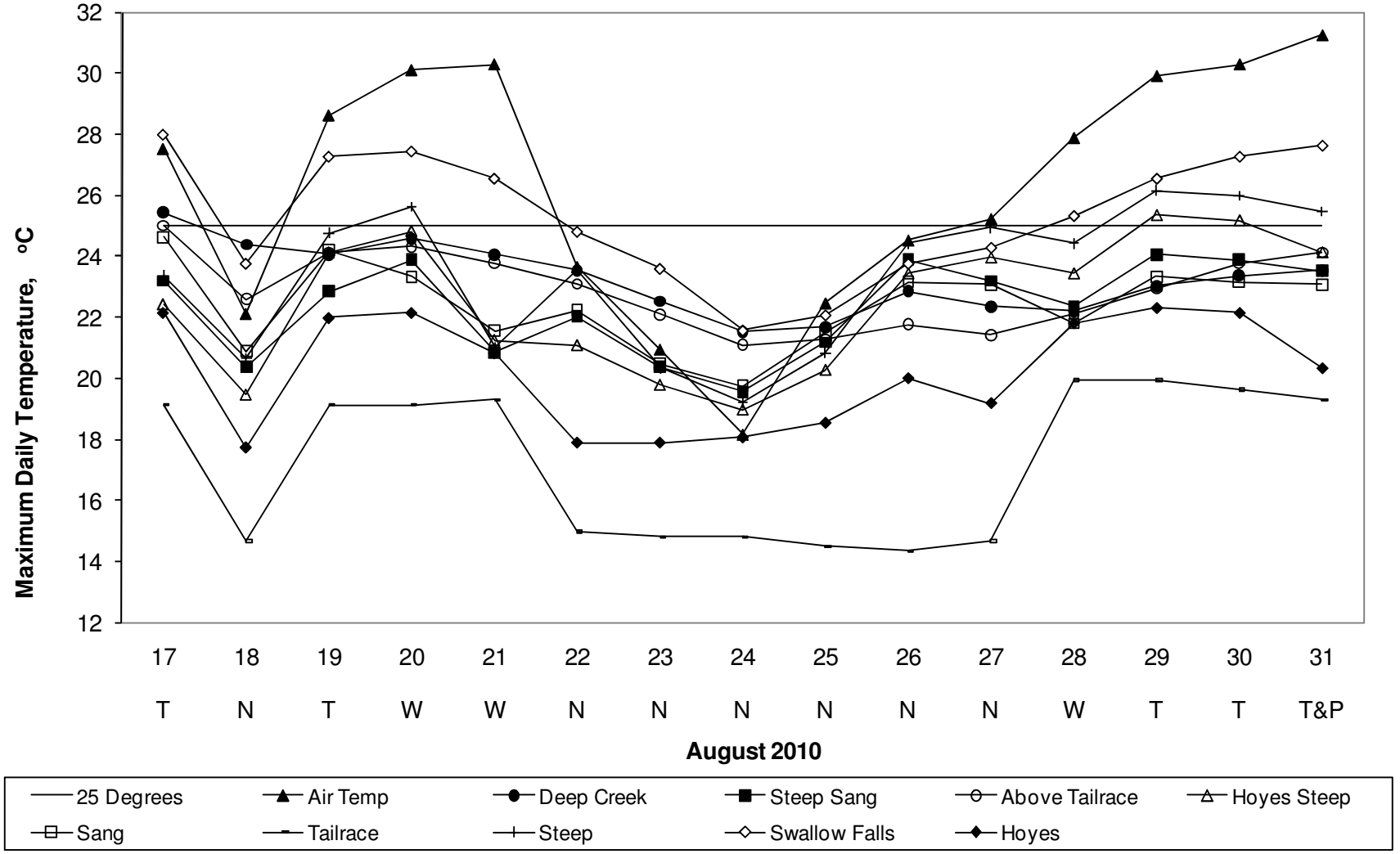

Figure 2-8. Maximum daily water temperature at several locations in the Youghiogheny River, August 17 - 31, 2010. Below each date is a code listing the primary type of release; W = whitewater; T = temperature enhancement; P = power; N = none.

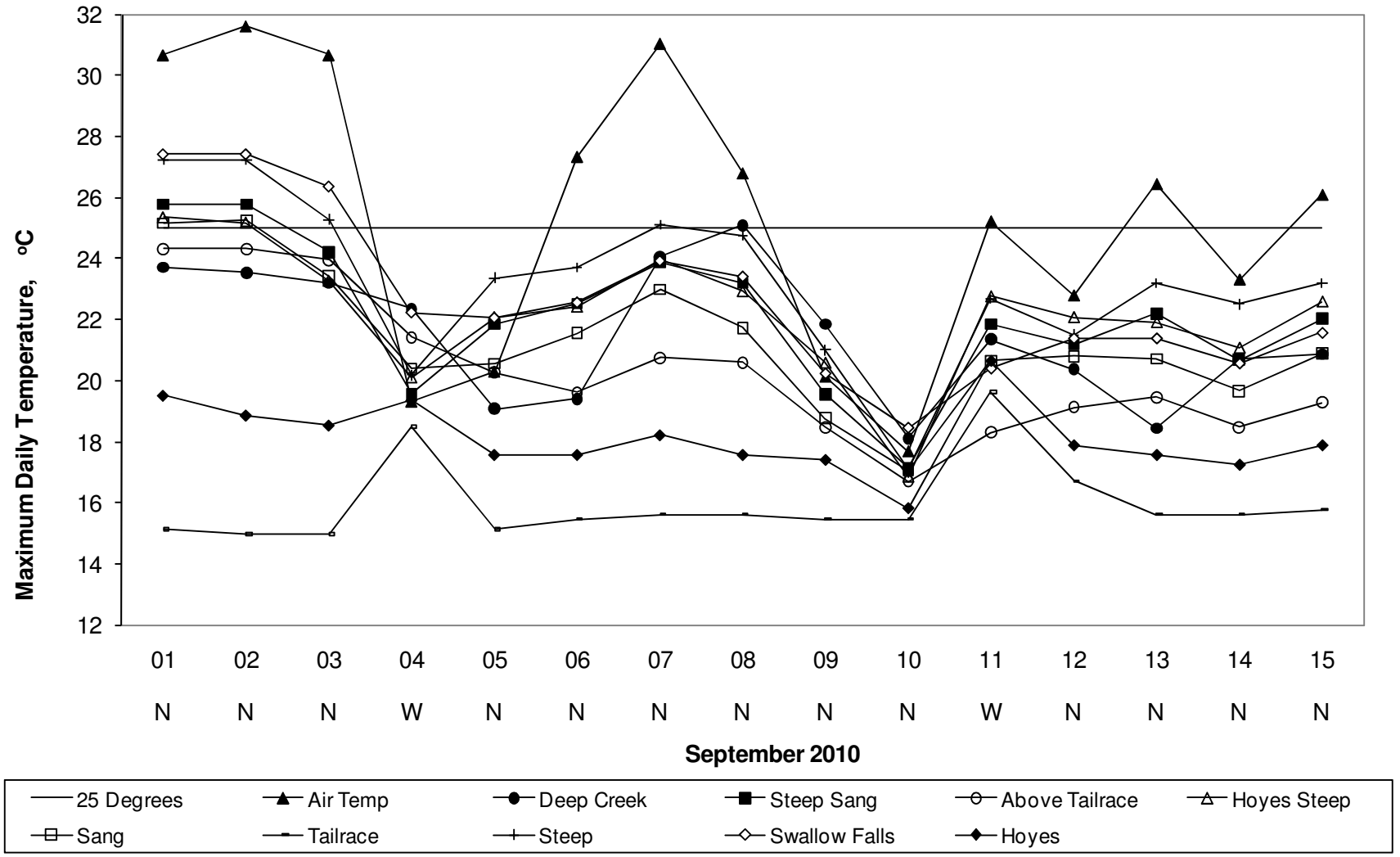

Figure 2-9. Maximum daily water temperature at several locations in the Youghiogheny River, September 1-15, 2010. Below each date is a code listing the primary type of release; W = whitewater; T = temperature enhancement; P = power; N = none.

2.3 SUMMARY AND CONCLUSIONS

The DNR Sang Run logger recorded 16 temperature exceedances in the Youghiogheny River in 2010. One of the exceedances at Sang Run was due to flow being greater than 150 cfs; 12 were due to model/protocol uncertainty, and three were due to operator error when an incorrect cloud cover factor was used.

Greater success in maintaining the target temperature of 25°C could be achieved by fully implementing the protocol changes included in the Revised Temperature Enhancement Plan adopted by MDE on February 1, 2009, as recommended in Schreiner et al. (2006). These recommendations included raising the flow exemption threshold from 100 cfs to 150 cfs, reducing the low-morning-temperature threshold for release exemption from 23°C to 20°C and revising the cloud-cover factor values for thunderstorms and showers used in the protocol software. The cloud-cover factor recommendation does not appear to have been implemented in the protocol software that station operations used during 2010.

The temperature enhancement protocol language regarding scheduled releases should be revised back to the original language for this section, to avoid unnecessary releases for temperature enhancement on whitewater release days.

3.0 REFERENCES

Schreiner, S.P., J.R. Dew, and C.M. Bruce. 2006. Youghiogheny River Temperature Enhancement Protocol for Operating Deep Creek Hydroelectric Station: Model Development and Results for 1995-2005 Versar, Inc., PPRP-DC-5, DNR 12-8232006-163, August 2006.

Schreiner, S.P., J. Dew-Baxter, and A.W. Klotz. 2009. Temperature and Trout Habitat Enhancement for Operating Deep Creek Hydroelectric Station: Operating Protocol Development and Results for 1995-2008, Versar, Inc., PPRP-DC-6, DNR Unavailable, September 2009 (draft).

APPENDIX A

TABULAR SUMMARY OF DATA FOR EVALUATING THE TEMPERATURE ENHANCEMENT PROTOCOL AT THE DEEP CREEK STATION IN 2010

Tabular Summary of Data for Evaluating the Temperature Enhancement Protocol at the Deep Creek Project in 2010

Variables:

OFLOW	Youghiogheny River at Oakland daily average flow (cfs)
TFLOW	Tailrace flow, based on conversion formula
Q	Instantaneous flow (cfs) in the Youghiogheny River at Oakland at start of daily protocol
SMEAN	Sang Run daily mean water temperature (DNR sensors)
SMIN	Sang Run daily minimum temperature (DNR sensors)
SMAX	Sang Run daily maximum temperature (DNR sensors)
PowerSmax	Sang Run daily maximum temperature (power company sensor)
SWAMAX	Swallow Falls daily maximum temperature
DCMAX	Deep Creek tributary daily maximum temperature
TAIR	Predicted maximum air temperature (Elkins)
OMIN	Oakland minimum air temperature
OMAX	Oakland maximum air temperature
EMIN	Elkins minimum air temperature
EMAX	Elkins maximum air temperature
CCF	Cloud cover factor, square of PCLD
PCLD	Predicted daily cloud cover factor (Elkins)
ECLD	Elkins average mid-day cloud cover (1000-1400)
OCLD	Oakland average mid-day cloud cover (1000-1400)
S7-S15	Sang Run river temperatures 0700-1500 (average of DNR sensors)
T7-T15	Sang Run river temperatures 0700-1500 (power company sensor)
STIME25	Time of temperature exceeding 25°C (DNR sensors)
STIMEMAX	Time of maximum temperature (if >25°C) (DNR sensors)
DurExceed	Duration of time exceeding 25°C
GEN	Generation (Y or N) (if < 15 min, then = N)
SG1, EG1	Start and end times of generation
ReleaseType	Type of release (whitewater, power, temperature)

2010 Youghiogheny River Temperature Enhancement Data - Deep Creek Project

Date	OFLOW	TFLOW	Q	SMEAN	SMIN	SMAX	PowerSmax	SWAMAX	DCMAX	TAIR	OMAX	OMin	EMIN	EMAX	CCF	PCLD	ECLD	OCLD
6/1/2010	160	231	171				22.94			27.22	27.2	14.4	17.22	27.78	100	10	9.5	
6/2/2010	129	187	151				25.63			29.44	25.0	12.2	14.44	28.33	36	6	8	
6/3/2010	104	152	118				22.05			27.78	27.2	12.8	13.89	28.33	36	6	4.5	
6/4/2010	96	141	115				22.21			28.33	25.0	16.7	13.89	28.89	64	8	2.563	
6/5/2010	286	405	93				23.06			27.78	28.3	18.9	15	28.89	100	10	7.75	
6/6/2010	1374	1859	692				21.03			25	23.3	17.2	16.67	26.67	100	10	8.643	
6/7/2010	1215	1649	1660				18.42			21.11	22.2	12.2	13.89	25.56	36	6	9.214	
6/8/2010	528	735	622				18.58			21.67	19.4	3.9	8.333	22.22	36	6	8.333	
6/9/2010	443	620	378				17.2			21.67	21.1	7.8	8.333	22.22	36	6	9.5	
6/10/2010	882	1209	12000				19.29			28.33			12.78	25.56	9	3	3.857	
6/11/2010	484	675	583				18.79			12.22	25.0	10.0	10.56	27.78	36	6	4.65	
6/12/2010	345	486	373				21.46			15	26.7	11.7	10.56	27.78	36	6	7.773	
6/13/2010	292	414	333				22.41			21.67	27.8	15.6	14.44	26.67	100	10	9.5	
6/14/2010	231	330	252				21.34			26.67	26.1	19.4	18.33	27.78	100	10	6.367	
6/15/2010	203	291	218				20.62			26.67	26.1	17.8	18.33	30	100	10	8.25	
6/16/2010	197	283	194				21.52			27.22	22.8	17.2	18.33	30	100	10	5.958	
6/17/2010	171	246	194	19.2	18	20.49	21.12	21.06	20.54	26.11	26.1	15.6	16.11	27.78	1	1	5.143	
6/18/2010	137	198	153	19.3	17.3	21.89	23.24	22.74	22.03	28.33	22.8	10.0	13.89	28.33	36	6	7.458	
6/19/2010	111	162	130	20.1	18.4	22.82	22.77	24.11	23.37	31.11	27.2	11.7	13.89	30	100	10	3.833	
6/20/2010	96	140	112	20.6	19.1	23.07	22.8	24.62	23.88	28.89	28.9	16.1	13.89	30	36	6	3.667	
6/21/2010	83	122	98	20.5	19.3	23.85	23.52	25.32	24.57	30	27.2	13.3	14.44	29.44	36	6	5.594	
6/22/2010	76	113	85	20.9	19.8	24.2	24.43	25.32	24.74	30.56	27.8	14.4	14.44	30.56	64	8	4.912	
6/23/2010	73	108	88	21.8	20	24.54	24.44	26.37	25.78	31.11	28.3	17.2	15	30.56	9	3	9.214	
6/24/2010	169	244	93	21.3	18.4	23.42	23.65	24.45	23.54	29.44	29.4	20.0	18.89	30	64	8	2.571	
6/25/2010	219	313	293	21.1	19.7	22.65	23.55	23.07	22.53	30	29.4	12.8	17.22	30	36	6	7.182	
6/26/2010	106	154	130	20.5	19	22.9	22.96	23.93	23.37	30	26.1	11.1	12.78	28.33	36	6	7.063	
6/27/2010	85	125	98	21.5	19.8	25.76	29.69	25.14	24.39	32.22	27.8	14.4	12.78	31.11	64	8	8.364	
6/28/2010	77	114	93	21.3	19.1	22.82	23.55	25.14	24.57	27.22	30.0	20.0	17.78	31.11	100	10	6.375	
6/29/2010	78	115	85	21.0	18.8	24.02	24.09	25.14	24.22	26.11	27.2	18.3	20	28.89	9	3	4.35	
6/30/2010	64	94	82	20.2	18.3	25.06	25.46	24.28	23.54	23.89	24.4	8.9	12.78	27.22	1	1	9.25	
7/1/2010	49	73	62	19.6	16.3	23.67	24.82	22.91	22.03	22.22			6.667	23.33	1	1	4.417	
7/2/2010	42	62	53	18.0	15.2	20.73	21.92	23.24	22.36	25	21.7	5.0	6.111	25	1	1	5.214	
7/3/2010	37	56	36	18.7	15.6	22.57	22.89	24.97	23.88	29.44	22.8	6.7	6.111	29.44	36	6	4.542	
7/4/2010	34	52	33	20.0	17	23.5	24.17	26.37	25.26	30.56	27.8	10.0	7.778	30	36	6	2.792	
7/5/2010	32	49	32	20.2	18.3	23.33	23.15	27.08	26.13	32.33	28.9	12.8	10	31.67	36	6	3.885	
7/6/2010	30	45	29	21.1	19.2	24.46	24.25	28.89	27.19	33.33	30.6	14.4	13.33	32.78	36	6	5.786	
7/7/2010	27	41	27	21.7	19.4	25.94	25.24	29.45	27.91	33.33	31.7	15.6	15	32.78	36	6	4.65	
7/8/2010	26	39	25	20.4	18.6	25.5	25.26	29.63	27.72	33.33	32.2	15.6	15.56	32.78	36	6	2.313	
7/9/2010	24	37	25	19.6	18.4	24.02	23.79	29.63	27.37	28.89	31.7	16.1	16.11	32.22	100	10	2.955	
7/10/2010	25	38	25	20.3	18.9	24.89	24.65	28.34	26.48	26.11	30.6	17.2	16.11	31.67	100	10	9.278	
7/11/2010	25	38	20	19.7	17.2	26.03	25.79	28.53	26.31	28.33	26.1	10.6	11.67	28.89	64	8	4.773	
7/12/2010	23	35	22	19.1	17.4	20.16	21.08	26.02	24.57	25	28.3	13.3	11.67	28.89	100	10	2.833	
7/13/2010	69	102	25	20.4	18.8	22.4	23.15	24.62	23.2	27.22	25.6	15.6	13.89	27.22	64	8	4.688	
7/14/2010	164	236	168	21.9	19.4	25.41	26.1	23.07	23.03	28.89	27.2	17.2	17.22	27.22	64	8	9.5	
7/15/2010	76	111	90	21.6	20.2	25.5	25.74	25.14	25.26	31.11	26.7	16.7	16.67	30	36	6	8.25	
7/16/2010	44	66	48	20.8	19.3	24.46	29.42	26.54	25.96	30.56	29.4	15.6	16.67	30	36	6	4.167	

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Date	OFLOW	TFLOW	Q	SMEAN	SMIN	SMAX	PowerSmax	SWAMAX	DCMAX	TAIR	OMAX	OMIN	EMIN	EMAX	CCF	PCLD	ECLD	OCLD
7/17/2010	38	57	36	20.8	18.9	22.65	23.34	26.72	25.78	31.11	29.4	16.7	16.67	30	36	6	5.364	
7/18/2010	35	52	36	21.5	19.2	23.33	24.32	26.54	25.43	29.44	28.3	20.6	18.33	29.44	64	8	7.611	
7/19/2010	143	207	78	21.0	19.7	23.67	24.04	25.67	25.61	30	27.8	18.9	18.33	29.44	64	8	8.625	
7/20/2010	97	143	106	22.7	20.1	26.11	26.04	25.32	25.09	28.89	27.8	18.3	18.33	28.33	100	10	8.5	
7/21/2010	64	95	70	22.0	20.2	25.24	26.16	24.97	24.74	28.33			18.33	27.78	100	10	9.5	
7/22/2010	47	70	50	22.3	20.7	25.68	25.48	26.9	26.83	29.44			20	30	1	1	7.188	
7/23/2010	34	51	36	22.1	20.5	25.68	25.82	28.71	28.27	31.67	29.4	17.8	18.33	31.11	100	10	7.636	
7/24/2010	28	42	29	21.5	19.6	26.11	26.18	29.45	28.63	32.78	30.6	21.7	18.33	31.67	36	6	8.833	
7/25/2010	43	65	25	21.2	19	25.76	25.56	27.79	26.66	31.11	31.1	22.8	19.44	31.67	100	10	7	
7/26/2010	83	123	112	21.8	20.6	25.76	25.11	26.72	26.83	28.33	28.9	15.0	18.33	30.56	36	6	7.147	
7/27/2010	41	62	48	21.1	19.3	24.98	24.91	27.08	26.48	29.44	27.2	12.8	13.89	29.44	100	10	6.357	
7/28/2010	29	44	30	20.8	18.9	26.03	26.28	27.79	27.01	28.89	28.9	12.8	13.89	30.56	64	8	8.5	
7/29/2010	25	38	25	21.4	19.4	23.67	24.16	28.16	27.01	28.33	30.0	16.1	15	30.56	100	10	9.1	
7/30/2010	26	39	26	20.0	18.4	23.85	23.65	26.72	25.43	25.56	27.8	10.6	13.33	27.22	36	6	8.208	
7/31/2010	23	35	25	19.4	17.8	22.99	23.07	26.54	24.91	25	23.9	11.7	13.33	26.67	64	8	8.333	
8/1/2010	28	43	32	21.2	19.2	24.46	25.74	25.32	24.39	26.11	25.6	14.4	15.56	26.67	100	10	9.5	
8/2/2010	22	33	22	20.3	18.1	22.15	23.17	26.37	25.26	27.78			13.89	27.78	36	6	2.833	
8/3/2010	19	29	19	19.7	18.7	21.31	21.82	24.62	23.88	29.44	25.0	15.0	13.89	27.78	36	6	5.333	
8/4/2010	20	31	19	20.2	19.2	24.71	24.65	26.37	24.74	30.56	25.6	16.7	15	31.11	100	10	8.344	
8/5/2010	43	65	33	20.4	19	22.57	23.46	24.11	23.2	28.89	28.3	18.9	18.33	31.11	100	10	7.444	
8/6/2010	47	71	56	20.6	19.8	23.33	23.51	25.14	25.09	27.22	24.4	18.9	22.22	26.67	36	6	7.833	
8/7/2010	33	50	39	20.0	17.6	22.4	23.55	24.8	24.91	27.78	25.0	19.4	14.44	26.67	36	6	8.639	
8/8/2010	21	33	24	20.1	17.6	24.54	24.78	27.08	25.61	29.44	26.1	11.7	14.44	28.89	36	6	6.433	
8/9/2010	17	26	18	20.8	17.9	23.85	24.97	28.16	26.13	29.44	28.3	12.8	14.44	30.56	36	6	8.25	
8/10/2010	16	25	16	21.2	19	23.33	24.33	28.34	25.96	30	30.6	13.3	16.11	31.11	36	6	5.773	
8/11/2010	16	25	15	21.7	20.2	23.93	24.26	28.53	26.66	31.11	30.6	15.6	16.11	31.11	64	8	4.857	
8/12/2010	18	27	19	21.1	18.9	22.4	23.4	27.08	26.13	30	31.1	17.2	20.56	30.56	64	8	9.5	
8/13/2010	18	27	17	21.3	20.4	24.46	24.55	26.19	25.09	30	27.2	18.3	18.89	31.11	64	8	8.333	
8/14/2010	16	25	18	20.8	19.2	23.07	24.38	26.72	24.91	29.44	23.9	17.8	18.89	31.11	64	8	5.583	
8/15/2010	15	23	16	21.5	20.2	25.15	26.37	27.26	25.43	28.99	23.9	18.3	19.44	30	100	10	9.192	
8/16/2010	15	24	15	21.4	19.9	23.42	24.68	27.79	25.96	27.78	28.9	18.3	20	30	36	6	5.45	
8/17/2010	15	24	16	20.4	18.2	24.63	24.91	27.98	25.43	28.89	28.9	13.9	17.22	30	64	8	8.5	
8/18/2010	13	20	14	19.4	18.2	20.9	21.89	23.76	24.39	24.44	28.3	11.1	17.22	28.89	64	8	9.5	
8/19/2010	13	19	13	19.9	16.9	24.2	24.53	27.26	24.05	28.89	28.3	11.1	15	28.89	36	6	9.5	
8/20/2010	13	20	13	20.4	17.6	23.33	24.62	27.43	24.57	30.56	28.9	11.1	12.78	30.56	36	6	7.1	
8/21/2010	12	18	13	19.9	18.1	21.56	22.13	26.54	24.05	31.11	30.6	13.9	12.78	30.56	36	6	5.367	
8/22/2010	14	22	13	20.5	19.4	22.23	23.22	24.8	23.54	26.11	30.0	14.4	14.44	28.33	64	8	9.5	
8/23/2010	19	30	16	19.5	18.4	20.49	21.45	23.59	22.53	23.33	25.0	16.7	16.11	26.67	64	8	6.556	
8/24/2010	30	45	24	18.7	17.8	19.75	20.62	21.57	21.53	23.33			15.56	23.33	64	8	8	
8/25/2010	26	39	29	19.3	17.5	21.47	22.24	22.07	21.69	24.44			15.56	23.89	64	8	9.5	
8/26/2010	19	29	20	20.0	17.5	23.16	24.33	23.76	22.86	24.44			14.44	25.56	64	8	8.929	
8/27/2010	15	23	16	19.5	15.9	23.07	24.32	24.28	22.36	26.11	24.4	8.3	10.56	26.11	36	6	8.406	
8/28/2010	12	19	13	18.7	15.2	21.81	23.37	25.32	22.19	28.33	25.6	7.2	10.56	29.44	36	6	8.556	
8/29/2010	11	17	12	19.6	16.1	23.33	24.74	26.54	23.03	29.44	27.2	7.2	11.67	30.56	1	1	7.056	
8/30/2010	10	15	10	20.2	17.2	23.16	24.52	27.26	23.37	31.67	30.6	11.1	13.89	31.67	1	1	7.067	
8/31/2010	10	15	10	20.0	16.8	23.07	24.55	27.62	23.54	31.67	31.1	11.1	13.89	31.67	1	1	7.458	

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Date	S7	S8	S9	S10	S11	S12	S13	S14	S15	T7	T9	T11	T12	T14	T15	STIME25	STIMEMAX	DurExceed	GEN	SG1	EG1	SG2	EG2	ReleaseType
6/1/2010										19.18									N					N
6/2/2010										18.52									Y	13:00	18:00			P
6/3/2010										19.12	19.3	20.02	20.53	21.78	22.09				Y	13:00	19:00			P
6/4/2010										19.08	19.3	20.25	21.51	18.43	18.55				Y	11:00	15:00	15:15	16:00	W&P
6/5/2010										20.39	20.5	21.14	21.67	21.85	22.7				N					N
6/6/2010										19.9									Y	15:00	0:00			P
6/7/2010										16.9									Y	0:00	0:00			W&P
6/8/2010										15.29									Y	0:00	1:15	7:15	10:00	P
6/9/2010										16.43									N					N
6/10/2010										16.15									Y	11:30	12:15			P
6/11/2010										16.96									Y	11:00	11:30	11:30	14:15	W&P
6/12/2010										17.72									N					N
6/13/2010										19.52									N					N
6/14/2010										20.06									Y	11:00	14:00	15:30	16:30	W&P
6/15/2010										20.04									Y	11:30	14:00			P
6/16/2010						21	21.1	19.6	19.1	19.27									Y	12:00	17:00			P
6/17/2010	18.9	18.9	19	19.2	19.4	19.7	20.2	19.3	18	19.49									Y	12:00	14:00			P
6/18/2010	17.4	17.4	17.6	18.4	19.4	20.7	21.4	18.9	19	17.67									Y	11:00	14:00			W
6/19/2010	18.4	18.4	18.8	19.5	20.6	21.9	22.5	19.7	19.8	19.11	19.07	20.37							Y	11:00	15:00			W&T
6/20/2010	20.1	20.1	20.5	21	21.8	22.4	20.7	19.2	19.3	20.69	20.92	21.51							Y	10:45	15:00			T&P
6/21/2010	19.3	19.3	19.7	20.5	21.6	23	23.8	19.6	19.5	20.04	19.94	21.46							Y	11:00	15:00			W&T
6/22/2010	19.8	19.9	20	20.2	20.6	21.5	23	24.1	20.2	20.57	20.65	21.2							Y	12:30	14:30			T
6/23/2010	20.6	20.6	21	21.4	22.3	23.9	24.3	20	20.3	21.2	21.5								Y	11:00	13:15			T
6/24/2010	20.8	20.9	21.2	21.6	22.1	23	23.4	23.2	19.8	21.44	21.72	22.48							Y	12:45	14:45			T
6/25/2010	20.6	20.6	20.7	21.1	21.5	22.2	21	19.7	20.2	21.32									Y	11:00	14:00			W
6/26/2010	19	19	19.3	20.1	21.2	22.3	22.9	19.7	19.7	19.74	19.72	21.11							Y	11:00	14:30			W&T
6/27/2010	20.1	20.2	20.6	21.3	22.5	23.8	25	25.8	21.2	20.74	21.05	22.64				13:30	14:30	1.5	Y	12:45	14:45			T
6/28/2010	21.2	21.3	21.4	21.9	22.1	22.4	22.6	19.1	19.8	21.87	21.96	22.75							Y	11:00	14:30			W&T
6/29/2010	20.6	20.6	20.9	21.5	22.5	23.2	23.7	23.8	19.1	21.26	21.54	22.63							Y	12:00	14:45			T
6/30/2010	18.4	18.4	18.7	19.3	20.2	21.5	22.6	23.9	24.9	19.24	19.54	20.42	21.11	23.84		15:30	15:30	0.5	Y	14:00	15:15			T
7/1/2010	16.4	16.3	16.7	17.4	18.4	19.6	20.9	22	23	17.45	17.44	19.1	20.39	22.16	23.31				N					N
7/2/2010	15.2	15.2	15.6	16.4	17.4	18.9	20.7	18.5	18.7	16.26	16.18	17.91	19.21	18.75	19.36				Y	11:00	14:15			W
7/3/2010	15.6	15.6	16	17	18.2	19.8	22.6	19.3	19.3	16.74	17.67	18.83	20.91						Y	11:00	14:15			W
7/4/2010	17.1	17	17.4	18.3	19.5	21	23.5	19.5	20	18.04	18.5								Y	11:00	13:00			T
7/5/2010	18.4	18.3	18.6	19.5	20.2	21.1	23.3	19.7	19.3	19.34									Y	11:00	14:00			W
7/6/2010	19.3	19.2	19.7	20.3	21.6	22.6	24.5	19.8	19.8	20.26									Y	11:00	13:30			T
7/7/2010	19.5	19.5	19.8	20.7	22	23.3	25.9	20.3	20.5	20.5						13:00	13:00	0.5	Y	11:00	13:15			T
7/8/2010	19.8	19.7	20	20.8	22	23.3	25.5	20.1	19.4	20.7						13:00	13:00	0.5	Y	11:00	15:30			T&P
7/9/2010	19.2	19.2	19.5	20.3	21.3	22.3	24	19.5	19.1	20.16	20.26	21.92							Y	11:00	15:00			W&T
7/10/2010	19.8	19.8	19.8	20.5	21.6	22.8	24.9	20.2	19.7	20.65	21.54	22.41	23.71						Y	11:00	14:15			.
7/11/2010	17.3	17.2	17.6	18.7	19.8	21.1	22.7	24.2	23.3	18.45	18.27	20.45				14:30	14:30	0.5	Y	11:30	14:30			T&P
7/12/2010	18.1	18	18.3	18.8	19	19.3	19.6	17.4	18.2	19.22	19.33	19.93	20.11	18.35	18.9				Y	11:00	14:00			W
7/13/2010	18.9	18.9	19	19.3	19.7	20.2	20.7	21.5	22.1	19.82	20.01	20.51	21.03	22.2	22.67				N					N
7/14/2010	20.2	20.5	20.6	20.9	21.3	22.1	22.8	24	24.5	20.7						16:00	16:30	1.5	N					N
7/15/2010	20.4	20.5	20.8	21.5	22.2	23.4	24.6	25.5	20.6	21.05	21.45	22.36				13:30	14:00	1.5	Y	12:30	14:45			T
7/16/2010	20.2	20.1	20.5	21.3	22.1	23.3	24.5	19.8	19.3	21.16									Y	11:00	14:15			W

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Date	S7	S8	S9	S10	S11	S12	S13	S14	S15	T7	T9	T11	T12	T14	T15	STIME25	STIMEMAX	DurExceed	GEN	SG1	EG1	SG2	EG2	ReleaseType
7/17/2010	19.8	19.7	20	20.6	21.3	22.2	22.6	18.9	19.2	20.57									Y	11:00	14:00			W
7/18/2010	20.6	20.7	21	21.1	21.5	22	22.9	19.2	19.8	21.59	21.92								Y	11:00	13:00			T
7/19/2010	20.5	20.4	20.7	21.1	21.9	22.6	23.7	19.7	19.8	21.44	21.82	22.7							Y	11:00	14:30	15:45	17:45	W&T&P
7/20/2010	22.1	22	22.2	22.6	23.5	24.5	25.9	26.1	20.9	22.74	22.75	23.66				12:30	13:30	2.5	Y	12:30	14:30			T
7/21/2010	21.7	21.7	21.7	21.8	21.9	22.1	22.6	23.3	24	22.55	22.48	22.63	22.84	23.82	24.67	16:30	16:30	0.5	Y	13:00	14:00			T
7/22/2010	21.1	21.1	21.4	22.1	23	24	25.7	20.7	21	22.02						13:00	13:00	0.5	Y	11:00	13:00			T
7/23/2010	20.7	20.7	21.2	22.1	23.3	24.4	25.7	20.6	20.6	21.72	22.11					13:00	13:00	0.5	Y	11:00	14:00			W
7/24/2010	21.7	21.8	22.1	23	24	24.9	26.1	20.4	19.8	22.68						12:30	13:00	1	Y	11:00	16:00			W
7/25/2010	21	21.1	21.6	22.1	23	24.1	25.8	19.3	19	21.96						13:00	13:00	0.5	Y	11:00	13:00			T
7/26/2010	20.6	20.6	21.1	22.1	23.2	24.5	25.8	21.6	21.6	21.57	21.86	23.33				13:00	13:00	0.5	Y	11:00	15:00			W&T
7/27/2010	19.5	19.4	19.6	20.4	21.5	22.4	23.2	24	21	20.43	20.35	22.05							Y	12:30	14:45			T
7/28/2010	18.9	18.9	19.2	20	21	22	23.6	25.2	21.4	19.96	19.98	21.83				14:00	14:30	1	Y	12:30	14:45			T
7/29/2010	21	21.1	21.3	21.6	21.9	22.6	23.7	19.4	20.2	21.94	22.29								Y	11:00	13:15			T
7/30/2010	18.6	18.4	18.7	19.5	20.5	21.6	23.8	19.8	19.9	19.67	20.04	21.68							Y	11:00	14:15			W
7/31/2010	17.8	17.8	18.1	18.5	19.8	21	23	20	19.9	18.91	19.22	20.56	22.01	20.51	50.75				Y	11:00	14:15			W
8/1/2010	19.2	19.2	19.5	20.2	20.3	20.5	21.3	21.8	22.6	20.19	20.73	21.13	21.74	22.58	23.64				N					N
8/2/2010	18.1	18.1	18.4	18.9	20	20.8	22.1	20.6	21.1	19.22	19.63								Y	11:00	14:15			W
8/3/2010	18.9	18.9	18.9	19.3	19.8	20.3	21.3	18.7	19	19.95									Y	11:00	13:15			T
8/4/2010	19.9	19.8	19.9	20.2	20.6	21.4	22.1	23.3	20.2	20.8	20.93	22.09							Y	12:30	14:45			T
8/5/2010	19	19.1	19.3	19.8	20.2	20.4	20.6	20.9	21.3	19.93	20.37	21.04	21.2	21.74	22.09				N					N
8/6/2010	19.8	19.8	20.1	20.6	21.4	22.3	23.3	20.2	19.9	20.67	20.99	22.04							Y	11:00	14:00			W
8/7/2010	17.9	17.6	17.8	18.5	19.7	21.1	19.7	20	20.6	18.91	18.85	20.76							Y	10:00	13:15			W
8/8/2010	17.7	17.6	17.9	18.7	19.8	21	21.9	23	21.9	18.79	18.48	20.59							Y	12:30	14:45			T
8/9/2010	18	17.9	18.1	18.9	20	21.3	23.4	20.5	21.3	19.1	19.18								Y	11:00	13:15			W
8/10/2010	19.3	19	19.2	19.7	19.8	20.6	22.8	20.3	21	20.37									Y	11:00	13:00			T
8/11/2010	20.4	20.2	20.4	21.1	22	22.8	23.9	20.4	20.7	21.48									Y	11:00	13:15			T
8/12/2010	21.1	20.9	20.8	20.8	21	21.1	21.6	18.9	19.1	22.07									Y	11:00	13:00			T
8/13/2010	20.5	20.4	20.5	21.1	21.8	22.8	24.5	21.1	21.3	21.46									Y	11:00	13:15			W
8/14/2010	19.3	19.2	19.3	19.5	19.8	20.3	21.6	20.7	21.7	20.25	20.32								Y	11:00	14:15			W
8/15/2010	20.5	20.3	20.2	20.6	21.3	22.3	23.3	24.6	24.5	21.41	21.28	22.26				14:30	14:30	0.5	Y	12:45	14:45			T
8/16/2010	20.3	20.2	20.3	20.4	20.6	21.6	23.2	19.9	20.6	21.33	21.35								Y	11:00	13:00			W
8/17/2010	18.4	18.2	18.4	19	20.1	21	22.1	23.3	22.1	19.53	19.39	21.04							Y	12:30	14:45			T
8/18/2010	18.3	18.2	18.3	18.9	19	19.1	19.3	19.5	19.7	19.31	19.48	20.06	20.06	20.3	20.52				N					N
8/19/2010	17.1	16.9	17.1	17.8	18.9	20.2	21.5	22.8	22.4	18.07	18.34	19.78	21.41						Y	12:30	13:30			T
8/20/2010	17.8	17.6	17.7	18.4	19.3	20.5	22.2	20.5	21	18.99									Y	11:00	13:00			W
8/21/2010	18.4	18.1	18.2	18.8	19.7	20.8	21.6	19.8	20	19.54									Y	11:00	14:00			W
8/22/2010	19.8	19.6	19.5	19.4	19.6	19.9	20.3	20.6	20.8	20.67	20.45	20.54	20.85	21.62	22.07				N					N
8/23/2010	18.5	18.4	18.4	18.7	19.1	19.3	19.6	19.9	20.2	19.47	19.36	19.88	20.23	20.65	20.95				N					N
8/24/2010	17.8	17.8	17.9	18	18.2	18.5	18.7	19	19	18.77	18.78	19.08	19.4	19.84	19.86				N					N
8/25/2010	17.5	17.5	17.7	18.2	18.7	19.3	20	20.6	20.7	18.44	18.69	19.8	20.16	21.41	21.55				N					N
8/26/2010	17.6	17.5	17.6	18.2	18.9	19.8	20.6	21.5	22.3	18.49	19.66	19.84	20.6	22.88	23.11				N					N
8/27/2010	16.4	16	16	16.7	17.7	18.9	19.6	21	22	17.4	16.98	18.74	20.2	22.18	23.11				N					N
8/28/2010	15.6	15.2	15.4	16	17.1	18.4	20.9	20.5	21.1	16.63	16.82	18.82	20.02	21.51	22.4				Y	11:00	14:15			W
8/29/2010	16.4	16.1	16.3	16.8	18	19.2	21.1	20.5	21.5	17.55	17.6								Y	11:00	13:00			T
8/30/2010	17.6	17.2	17.2	17.7	18.7	19.8	21.6	20.4	21.3	18.75									Y	11:00	13:00			T
8/31/2010	17.2	16.8	16.9	17.6	18.5	19.7	21.6	20.7	21.3	18.4									Y	10:45	14:15			T&P

APPENDIX B

DAILY PLOTS OF RIVER FLOW AT OAKLAND AND WATER TEMPERATURE IN THE YOUGHIOGHENY RIVER AT SANG RUN FOR 2010

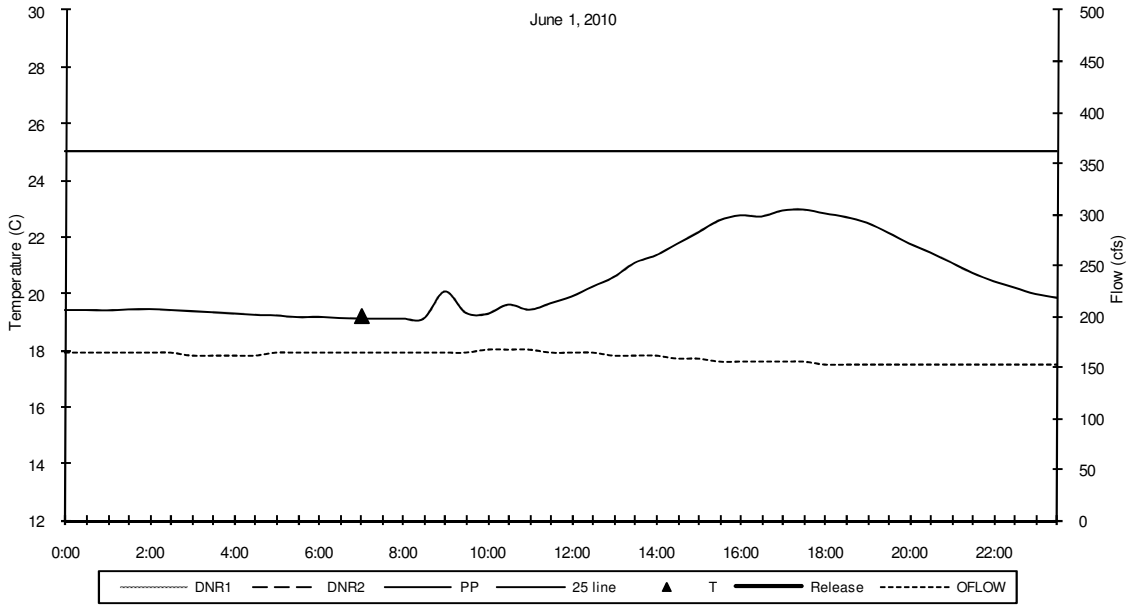
Tabular Summary of Data for Evaluating the Temperature Enhancement Protocol at the Deep Creek Project in 2010

Variables in the graph:

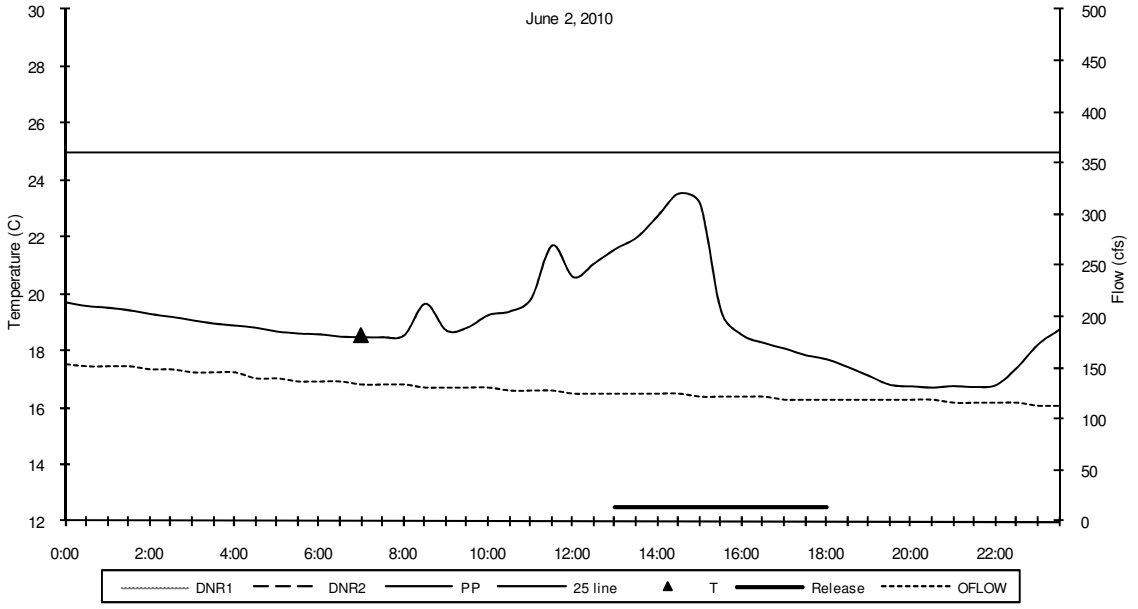
DNR1	Continuous Sang Run river temperature reading taken by the DNR sensor Sang1
DNR2	Continuous Sang Run river temperature reading taken by the DNR sensor Sang2
PP	Continuous Sang Run river temperature reading taken by the Power Company's sensor
T	Sang Run river temperatures taken hourly at 0700-1500 by the Power Company
Release	Time of a water release by the Power Company
OFLOW	Flow of the Youghiogheny River at Oakland

Variables in the table:

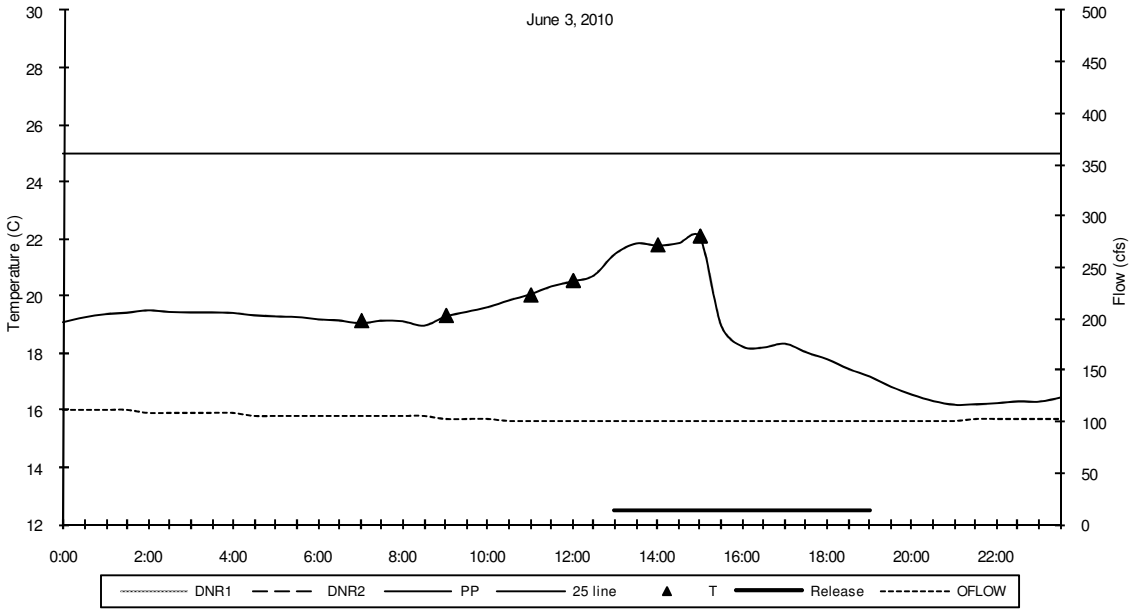
P7-P15	Predicted daily maximum river temperature calculated by Power Company to determine need for temperature enhancement release
P7a-P15a	Predicted daily maximum river temperature, based on actual values of cloud cover, maximum air temp, and DNR's river temperature sensor readings
P7b-P15b	Predicted daily maximum river temperature, based on predicted values of cloud cover, maximum air temperature and Power Company's temperature sensor readings
OFLOW	Youghiogheny River at Oakland daily average flow (cfs)
Q	Instantaneous flow (cfs) in the Youghiogheny River at Oakland at start of daily protocol
EMAX	Elkins maximum air temperature
OMAX	Oakland maximum air temperature
TAIR	Predicted maximum air temperature (Elkins)
PCLD	Predicted daily cloud cover factor (Elkins)
ECLD	Elkins average mid-day cloud cover (1000-1400)
SMAX	Youghiogheny River at Sang Run daily maximum temperature (DNR sensors)
SWAMAX	Youghiogheny River at Swallow Falls daily maximum temperature
STIMEMAX	Time of maximum temperature (if >25°C) (DNR sensors)
STIME25	Time of temperature exceeding 25°C (DNR sensors)



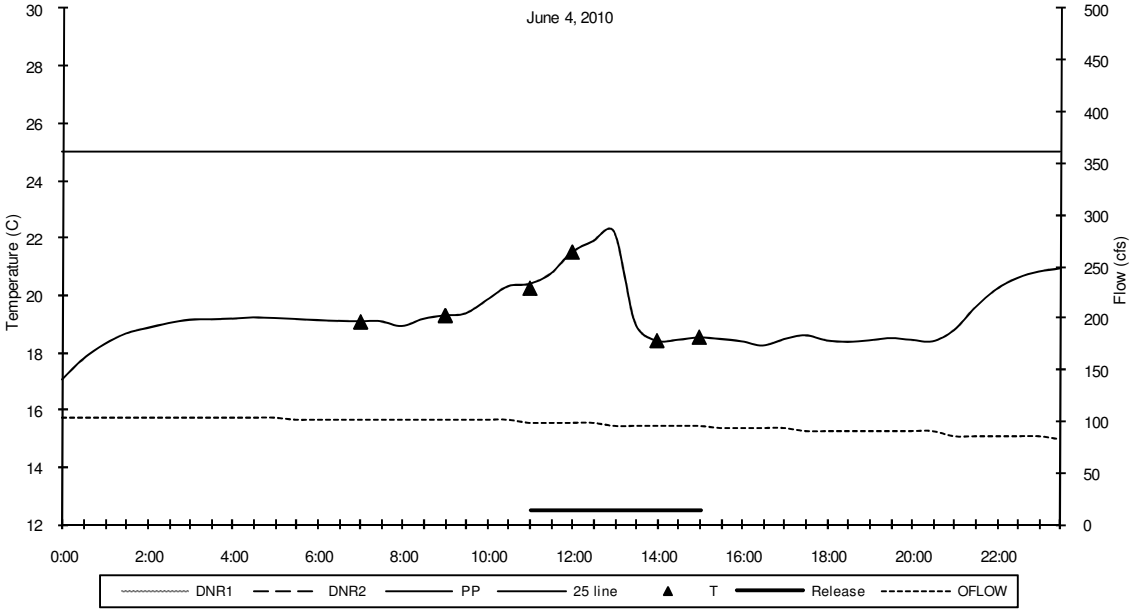
P7	P9	P11	P12	P14	P15			PCLD	10
21.5						OFLOW	160.4	ECLD	9.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	171	SMAX	
						EMAX	27.8	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.2	STIME25	
						TAIR	27.2	STIMEMAX	



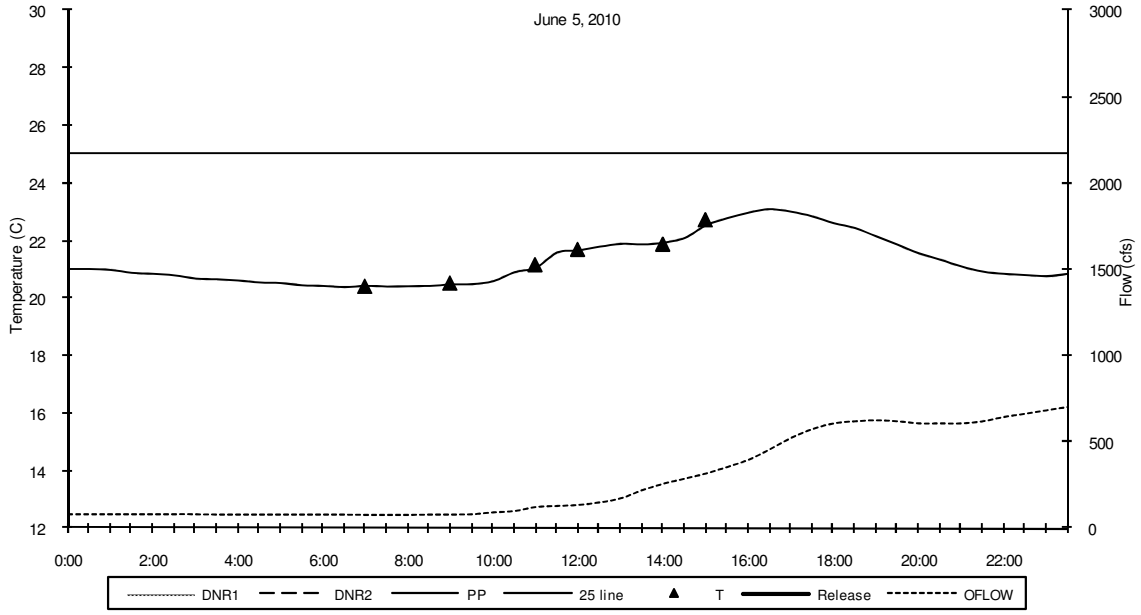
P7	P9	P11	P12	P14	P15	Power		PCLD	6
23.2						OFLOW	128.6	ECLD	8
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	151	SMAX	
						EMAX	28.3	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	25	STIME25	
						TAIR	29.4	STIMEMAX	



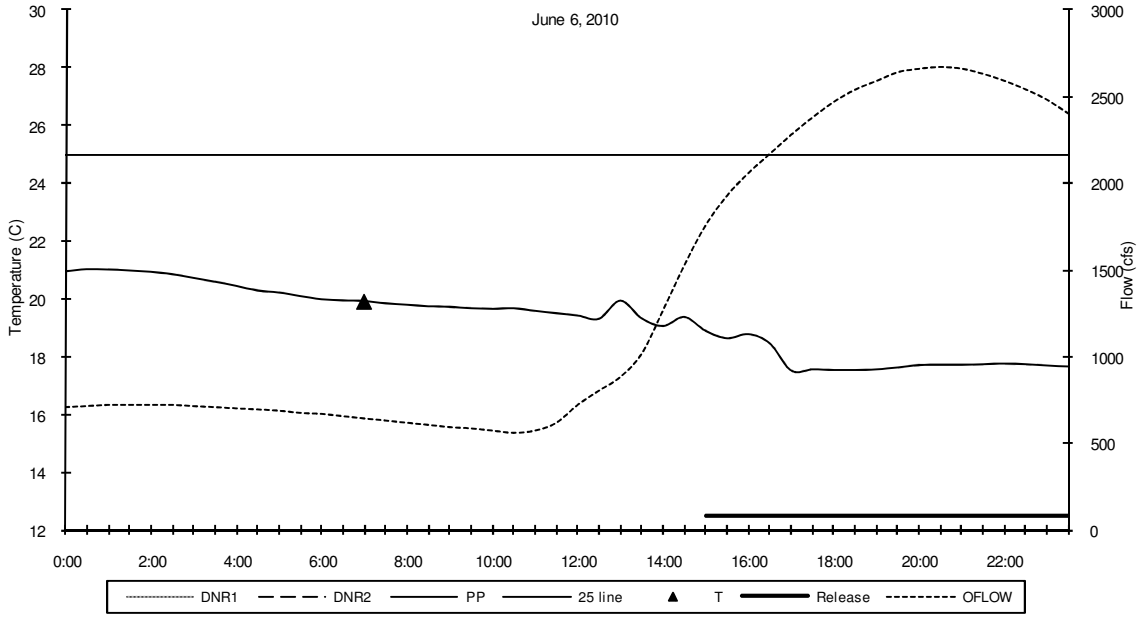
P7	P9	P11	P12	P14	P15	Power		PCLD	6
22.9	22.2	24.6	24.3	23.6	23.2	OFLOW	104	ECLD	4.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	118	SMAX	
						EMAX	28.3	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.2	STIME25	
22.1	22.2	24.6	24.3	23.6	23.2	TAIR	27.8	STIMEMAX	



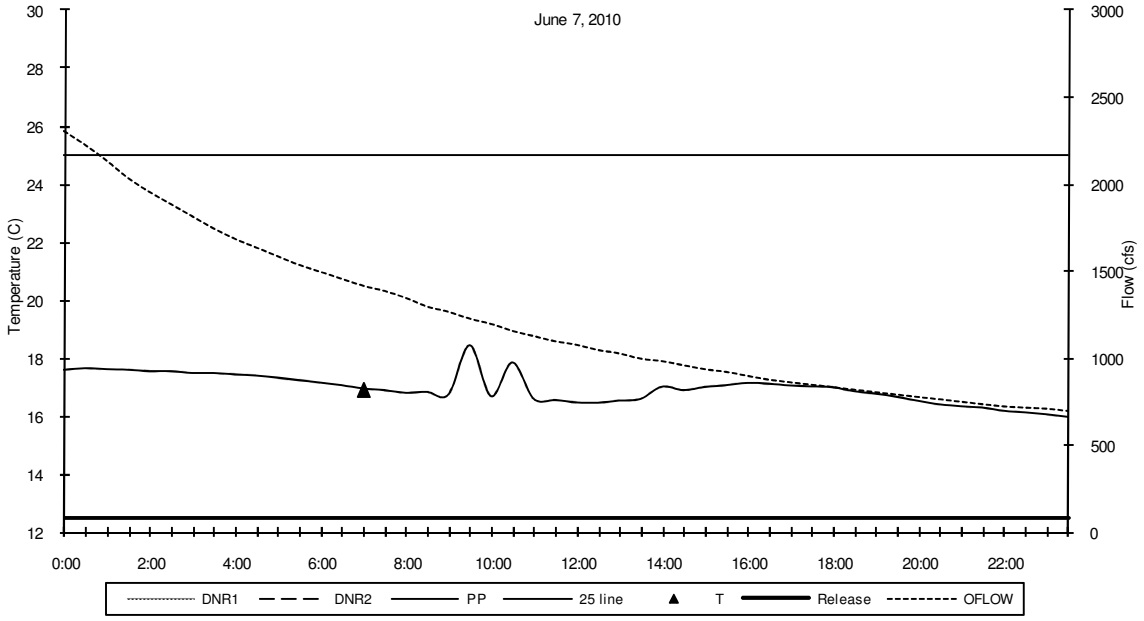
P7	P9	P11	P12	P14	P15	WhiteWater & Power		PCLD	8
22.5	22	24.8	25.2	18.56	18.9	OFLOW	96.2	ECLD	2.6
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	115	SMAX	
						EMAX	28.9	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	25	STIME25	
21.9	22	24.8	25.2	18.6	18.9	TAIR	28.3	STIMEMAX	



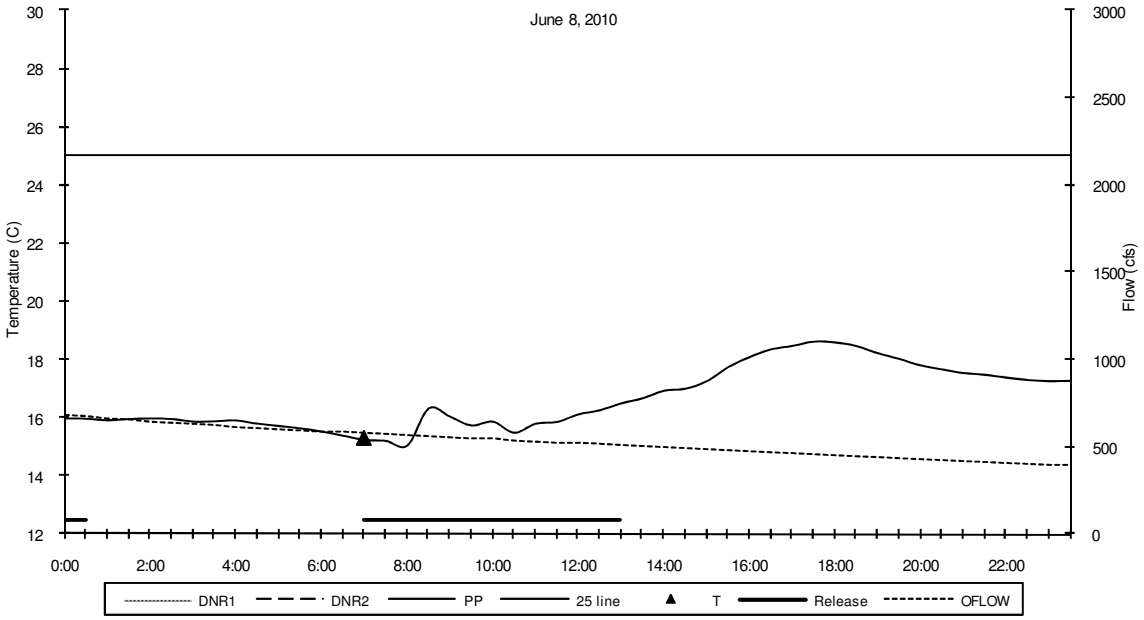
P7	P9	P11	P12	P14	P15			PCLD	10
22.4	22.4	24.5	24.5	23.1	23.6	OFLOW	285.9	ECLD	7.8
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	93	SMAX	
						EMAX	28.9	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.3	STIME25	
22.3	22.4	24.5	24.5	23.1	23.6	TAIR	27.8	STIMEMAX	



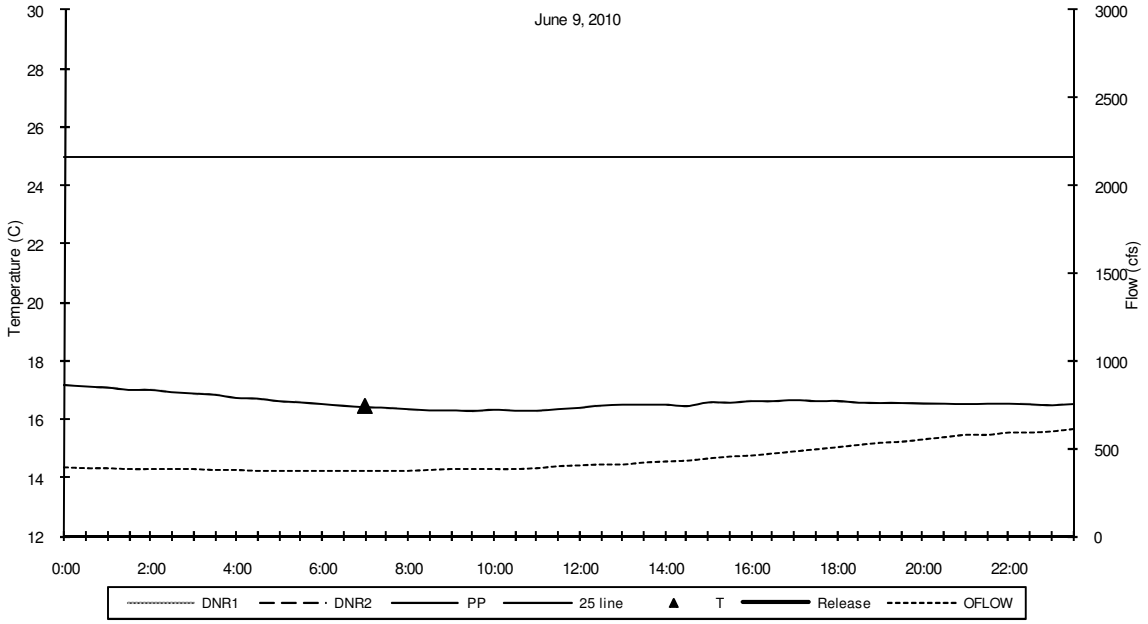
P7	P9	P11	P12	P14	P15	Power		PCLD	10
21						OFLOW	1374.4	ECLD	8.6
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	692	SMAX	
						EMAX	26.7	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	23.3	STIME25	
						TAIR	25	STIMEMAX	



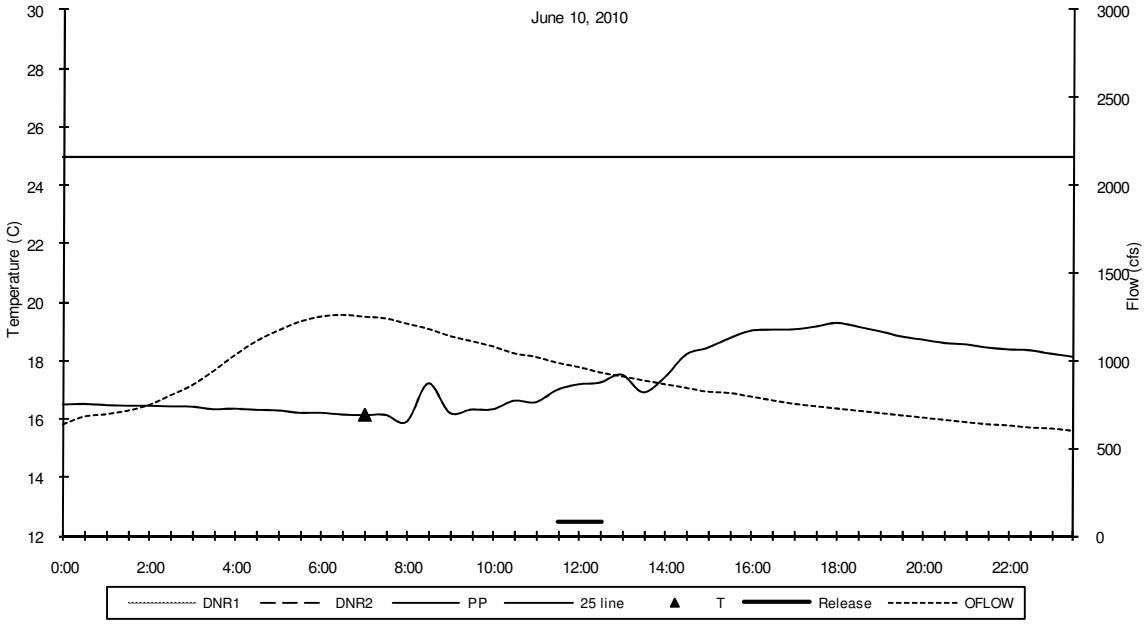
P7	P9	P11	P12	P14	P15	WhiteWater & Power		PCLD	6
						OFLOW	1214.8	ECLD	9.2
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	1660	SMAX	
						EMAX	25.6	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	22.2	STIME25	
						TAIR	21.1	STIMEMAX	



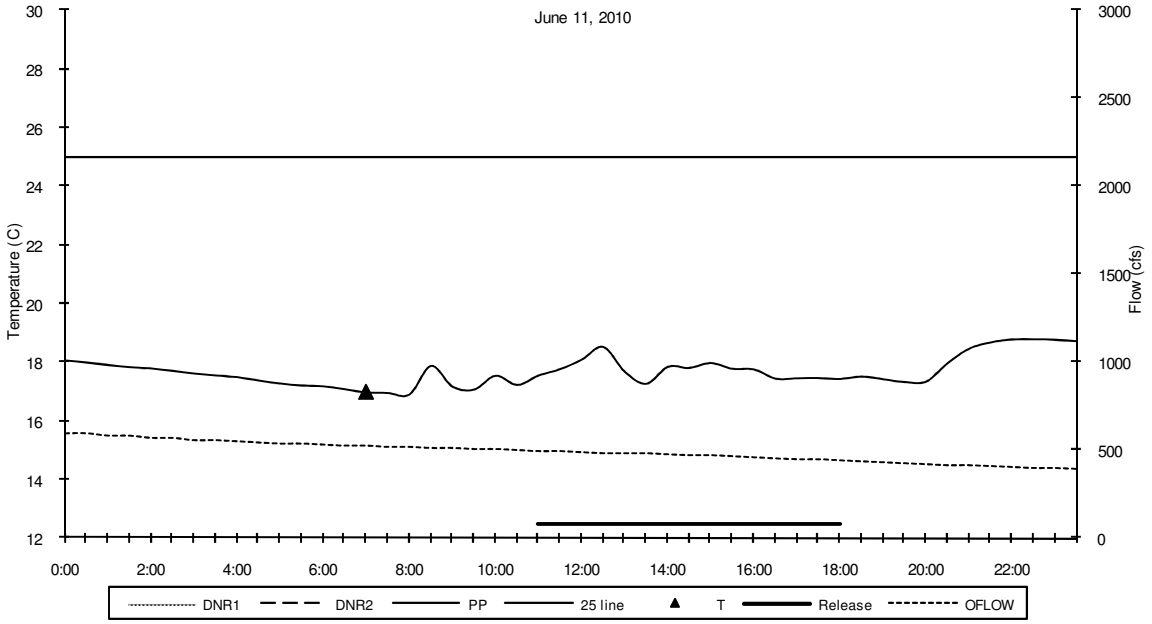
P7	P9	P11	P12	P14	P15	Power		PCLD	6
						OFLOW	527.8	ECLD	8.3
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	622	SMAX	
						EMAX	22.2	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	19.4	STIME25	
						TAIR	21.7	STIMEMAX	



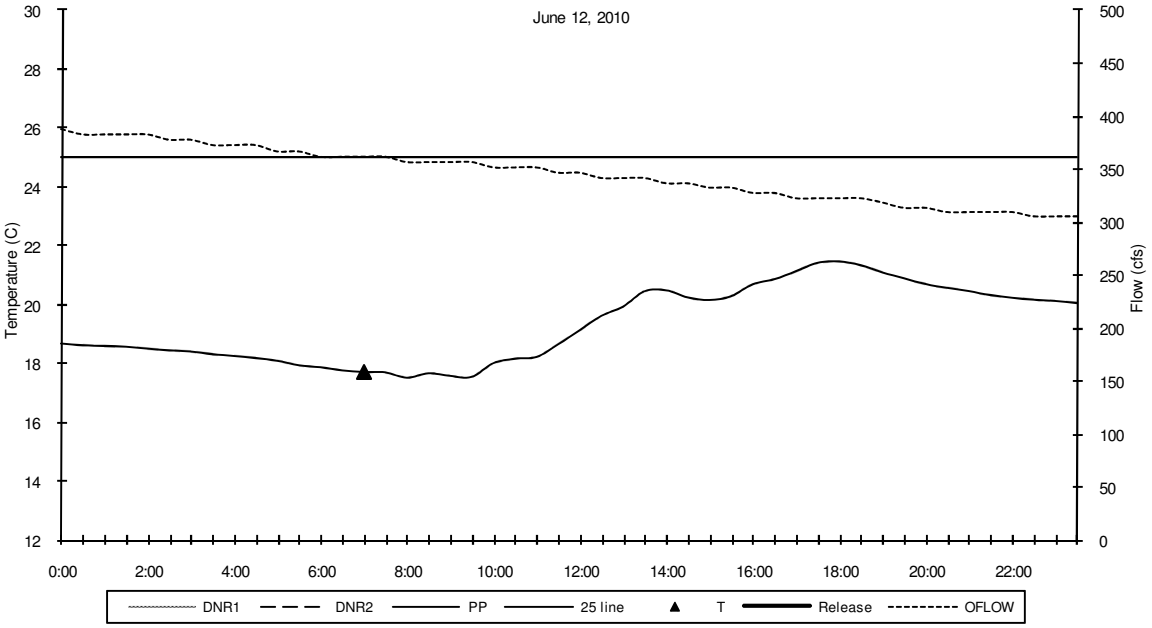
P7	P9	P11	P12	P14	P15			PCLD	6
						OFLOW	442.8	ECLD	9.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	378	SMAX	
						EMAX	22.2	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	21.1	STIME25	
						TAIR	21.7	STIMEMAX	



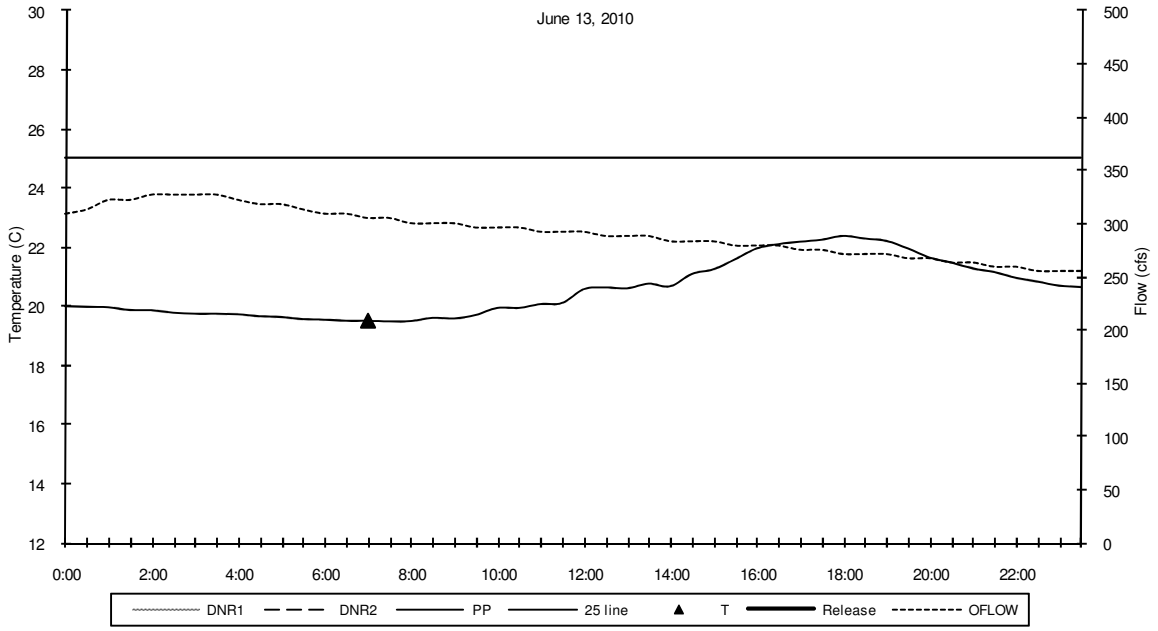
P7	P9	P11	P12	P14	P15	Power		PCLD	3
						OFLOW	881.7	ECLD	3.9
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	12000	SMAX	
						EMAX	25.6	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX		STIME25	
						TAIR	28.3	STIMEMAX	



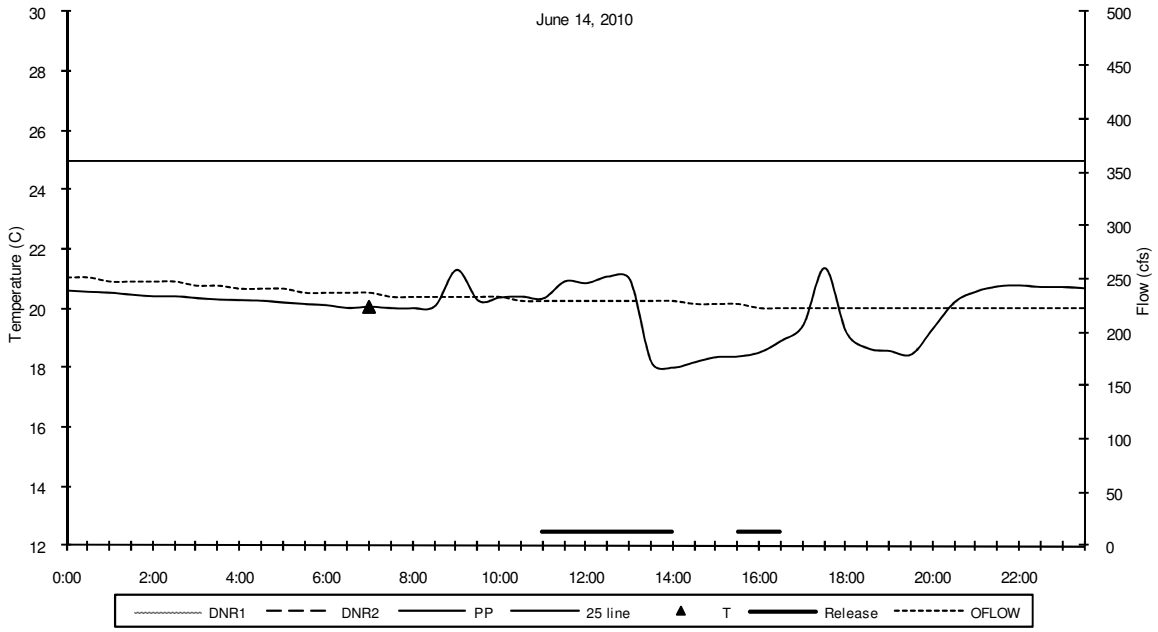
P7	P9	P11	P12	P14	P15	WhiteWater & Power		PCLD	6
						OFLOW	483.8	ECLD	4.7
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	583	SMAX	
						EMAX	27.8	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	25	STIME25	
						TAIR	12.2	STIMEMAX	



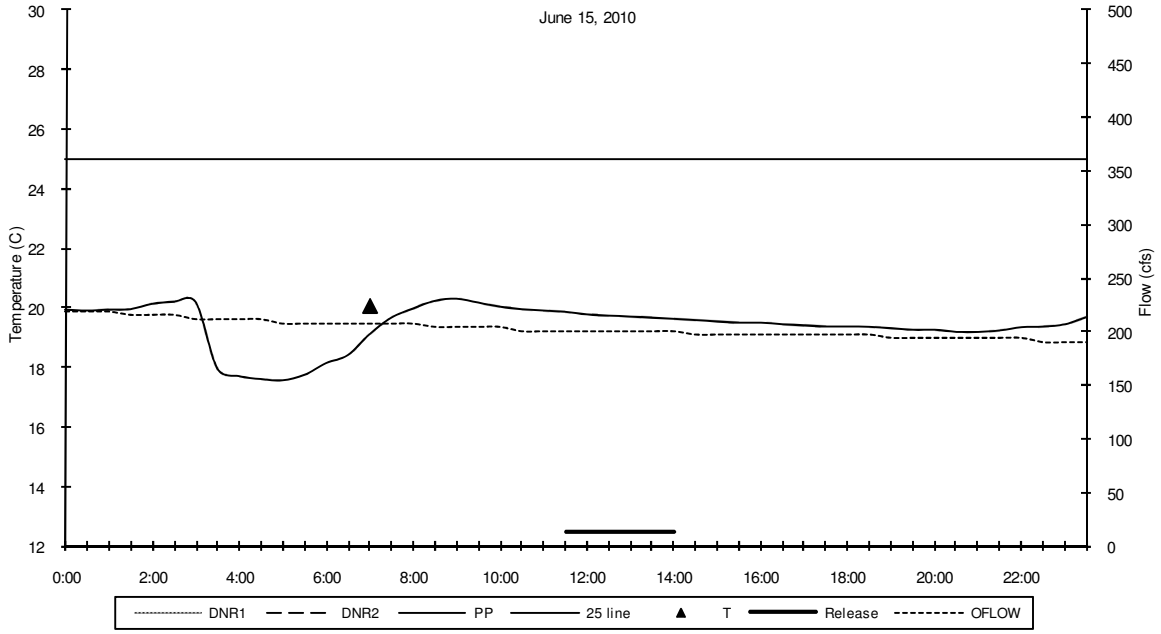
P7	P9	P11	P12	P14	P15			PCLD	6
						OFLOW	344.9	ECLD	7.8
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	373	SMAX	
						EMAX	27.8	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	26.7	STIME25	
						TAIR	15	STIMEMAX	



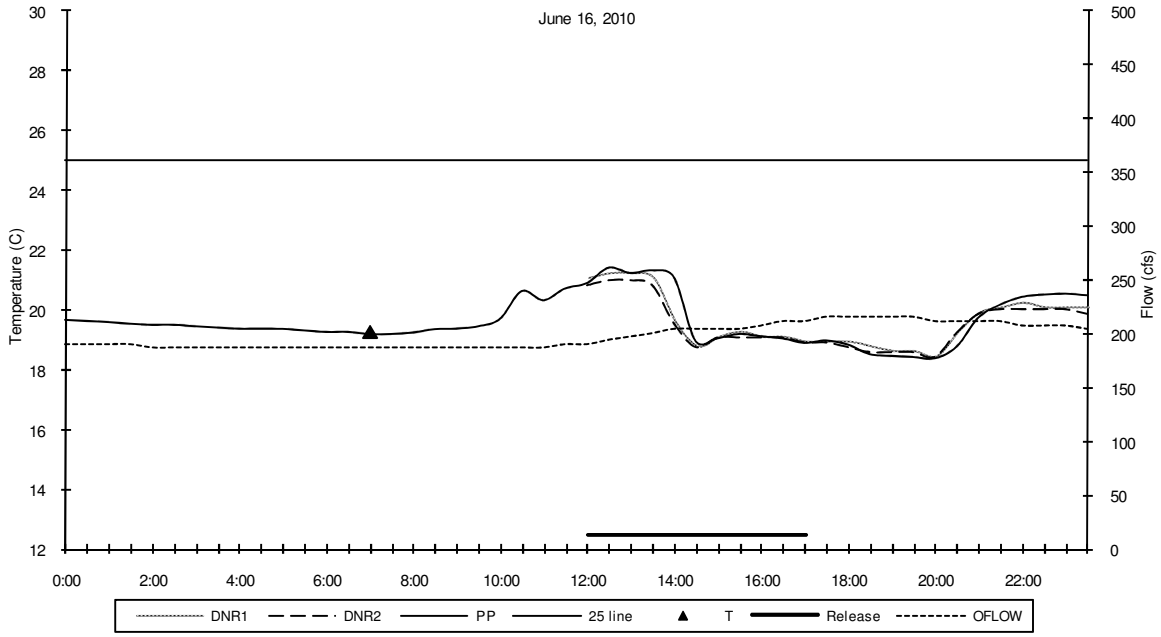
P7	P9	P11	P12	P14	P15			PCLD	10
						OFLOW	292.3	ECLD	9.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	333	SMAX	
						EMAX	26.7	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.8	STIME25	
						TAIR	21.7	STIMEMAX	



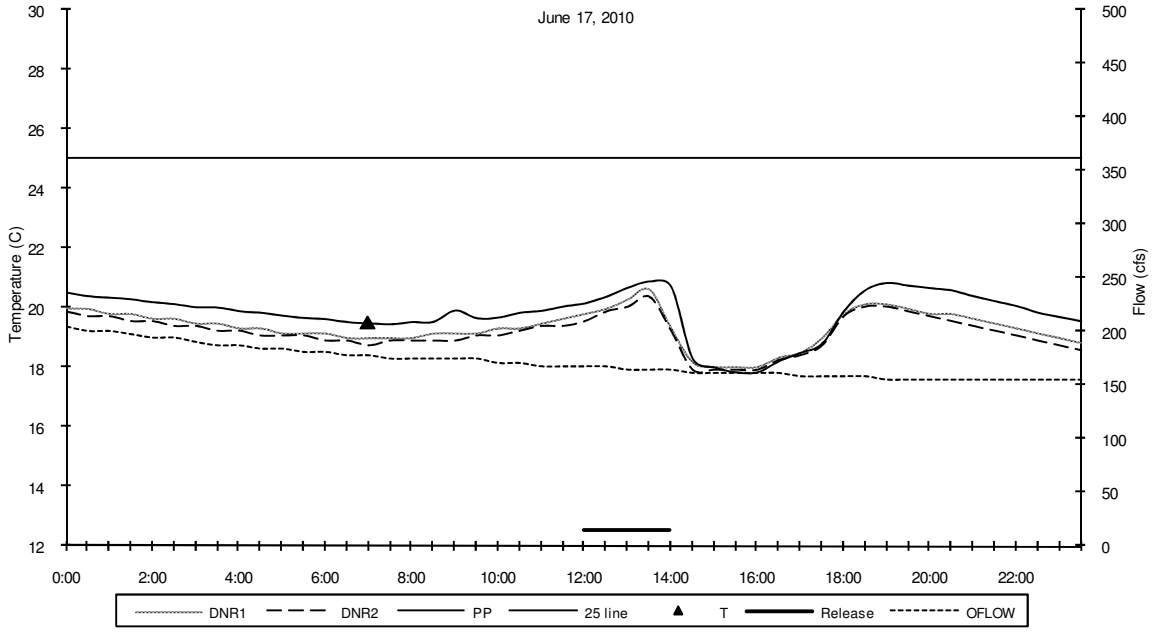
P7	P9	P11	P12	P14	P15	WhiteWater & Power		PCLD	10
21.6						OFLOW	231.5	ECLD	6.4
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	252	SMAX	
						EMAX	27.8	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	26.1	STIME25	
						TAIR	26.7	STIMEMAX	



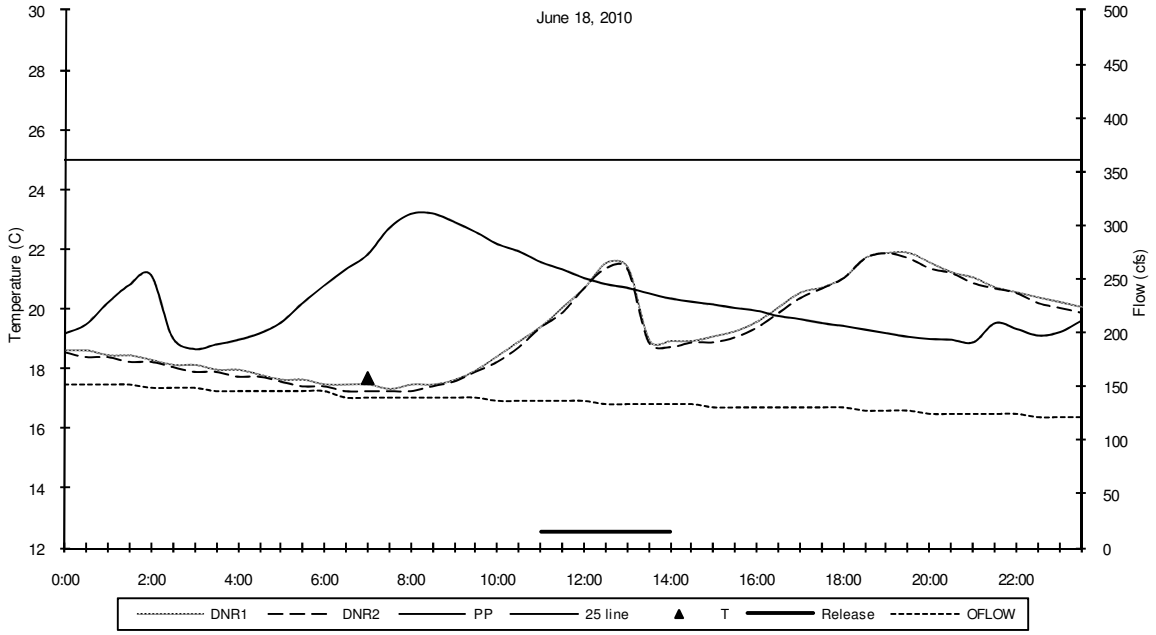
P7	P9	P11	P12	P14	P15	Power		PCLD	10
21.6						OFLOW	203.4	ECLD	8.3
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	218	SMAX	
						EMAX	30	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	26.1	STIME25	
						TAIR	26.7	STIMEMAX	



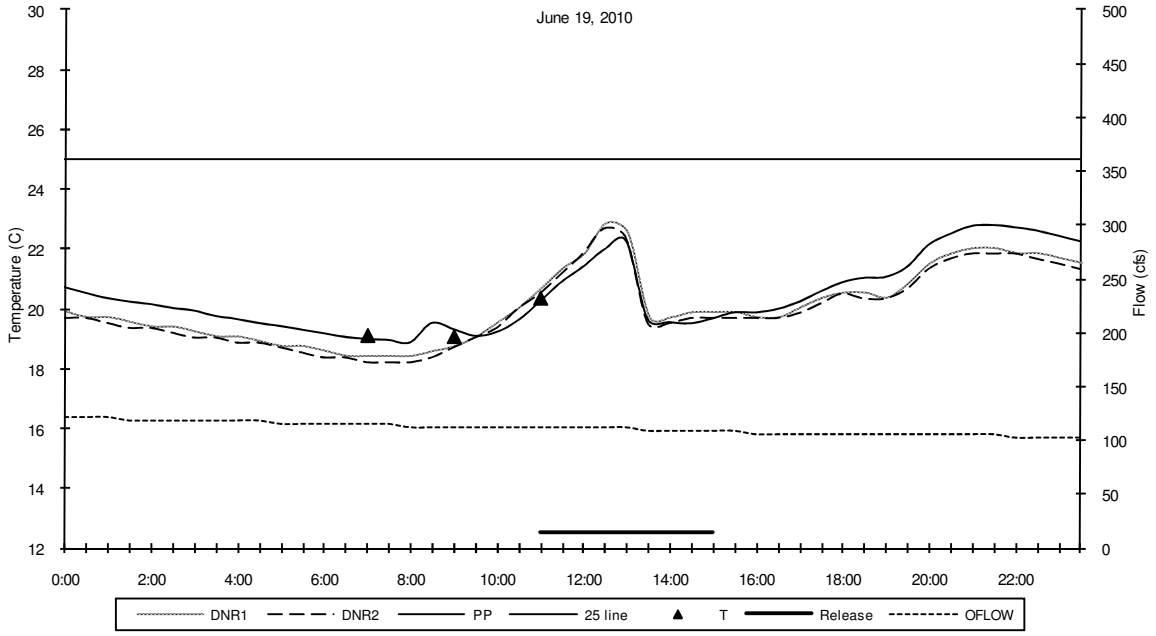
P7	P9	P11	P12	P14	P15	Power		PCLD	10
21.5						OFLOW	197.4	ECLD	6
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	194	SMAX	
						EMAX	30	SWAMAX	
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	22.8	STIME25	
						TAIR	27.2	STIMEMAX	



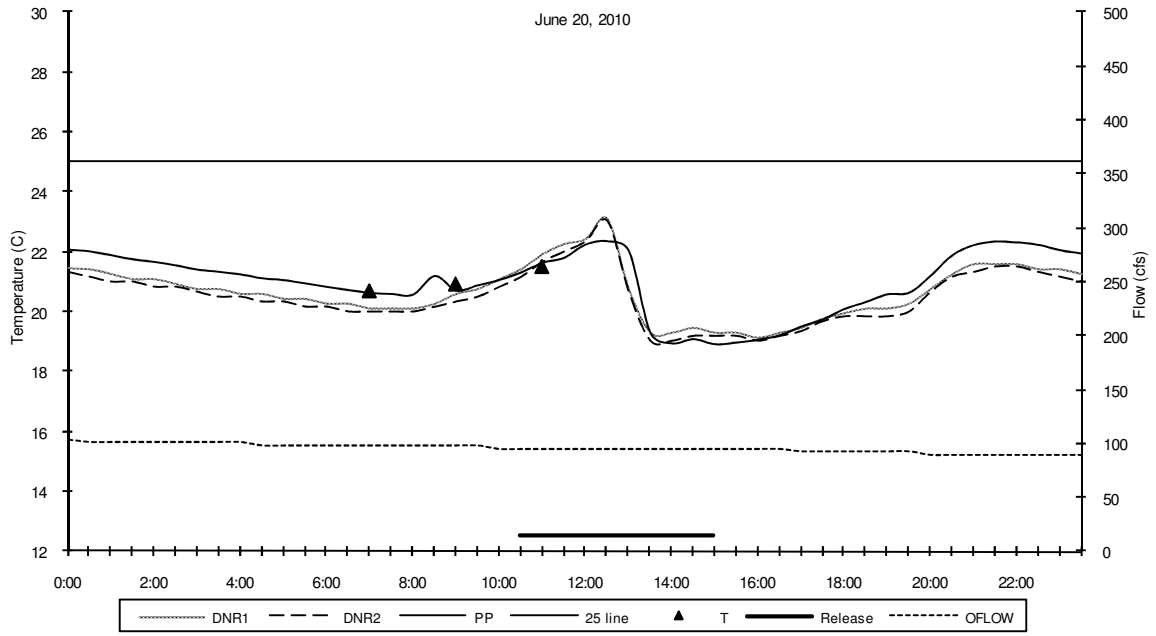
P7	P9	P11	P12	P14	P15	Power		PCLD	1
23.1						OFLOW	171.1	ECLD	5.1
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	194	SMAX	20.5
						EMAX	27.8	SWAMAX	21.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	26.1	STIME25	
						TAIR	26.1	STIMEMAX	



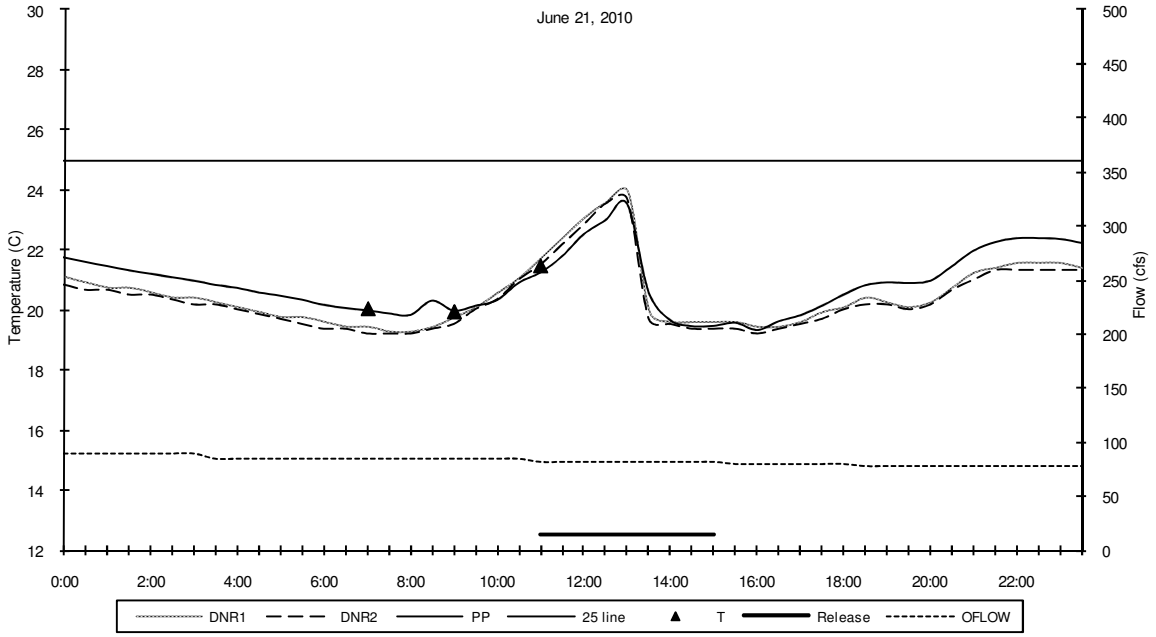
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
22.5						OFLOW	136.8	ECLD	7.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	153	SMAX	21.9
						EMAX	28.3	SWAMAX	22.7
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	22.8	STIME25	
						TAIR	28.3	STIMEMAX	



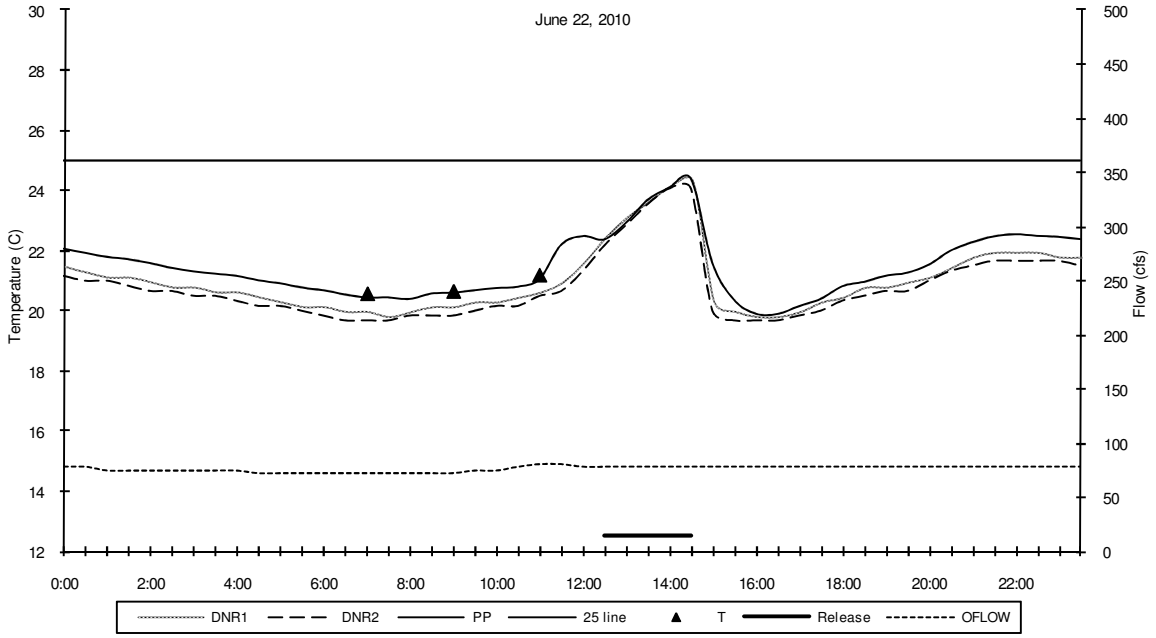
P7	P9	P11	P12	P14	P15	WhiteWater & Temperature		PCLD	10
22.7	21.1	25.5				OFLOW	111.2	ECLD	3.8
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	130	SMAX	22.8
22.5	22.8	26.7	26.6	20.2	20.3	EMAX	30	SWAMAX	24.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.2	STIME25	
21.5	21.1	25.5				TAIR	31.1	STIMEMAX	



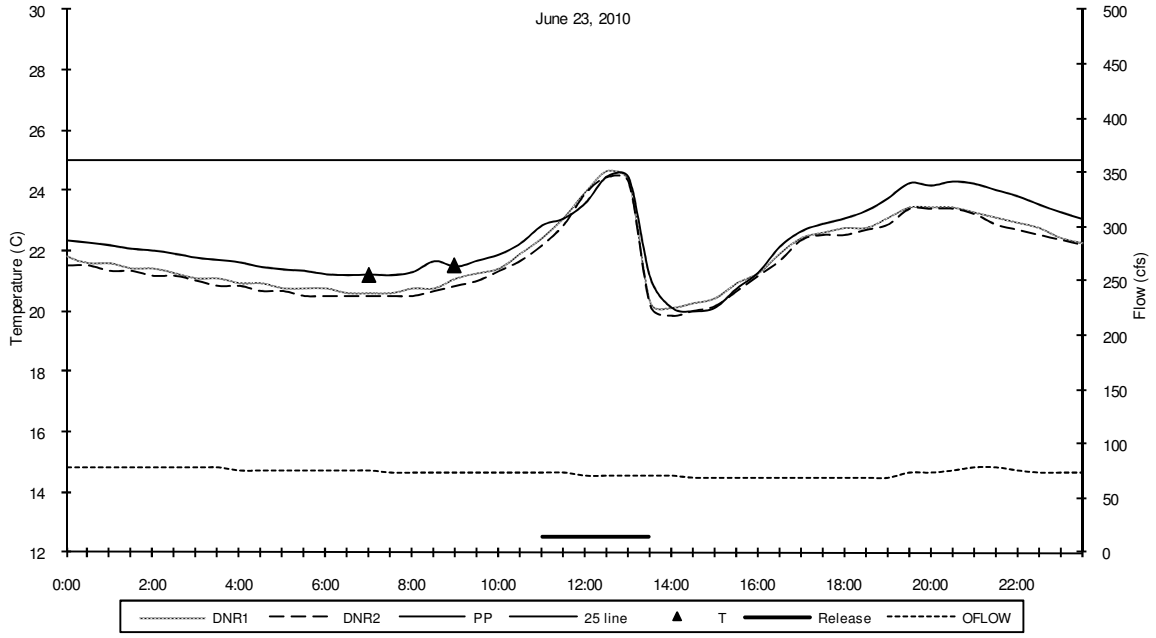
P7	P9	P11	P12	P14	P15	Temperature & Power		PCLD	6
23.7	23.5	25.6				OFLOW	95.8	ECLD	3.7
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	112	SMAX	23.1
23.8	24.3	26.9	26.4	19.2	19.5	EMAX	30	SWAMAX	24.6
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.9	STIME25	
23.3	23.5	25.6				TAIR	28.9	STIMEMAX	



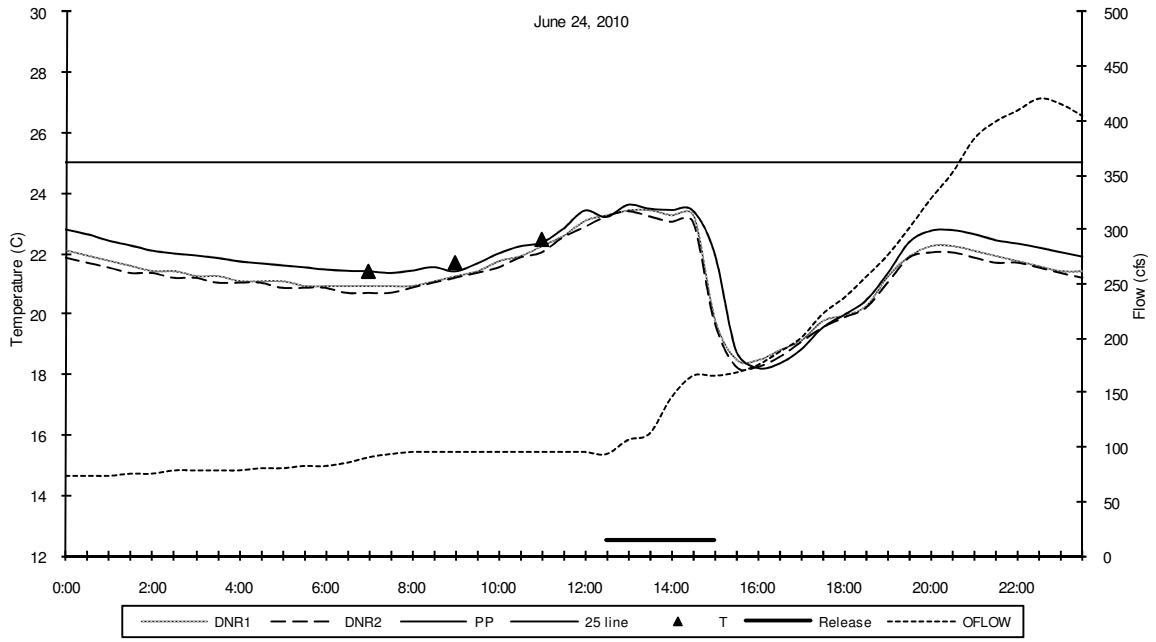
P7	P9	P11	P12	P14	P15	Whitewater & Temperature		PCLD	6
24	23.7	26.5				OFLOW	82.9	ECLD	5.6
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	98	SMAX	23.8
23.6	23.9	27	27.1	19.4	19.6	EMAX	29.4	SWAMAX	25.3
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.2	STIME25	
24	23.7	26.6				TAIR	30	STIMEMAX	



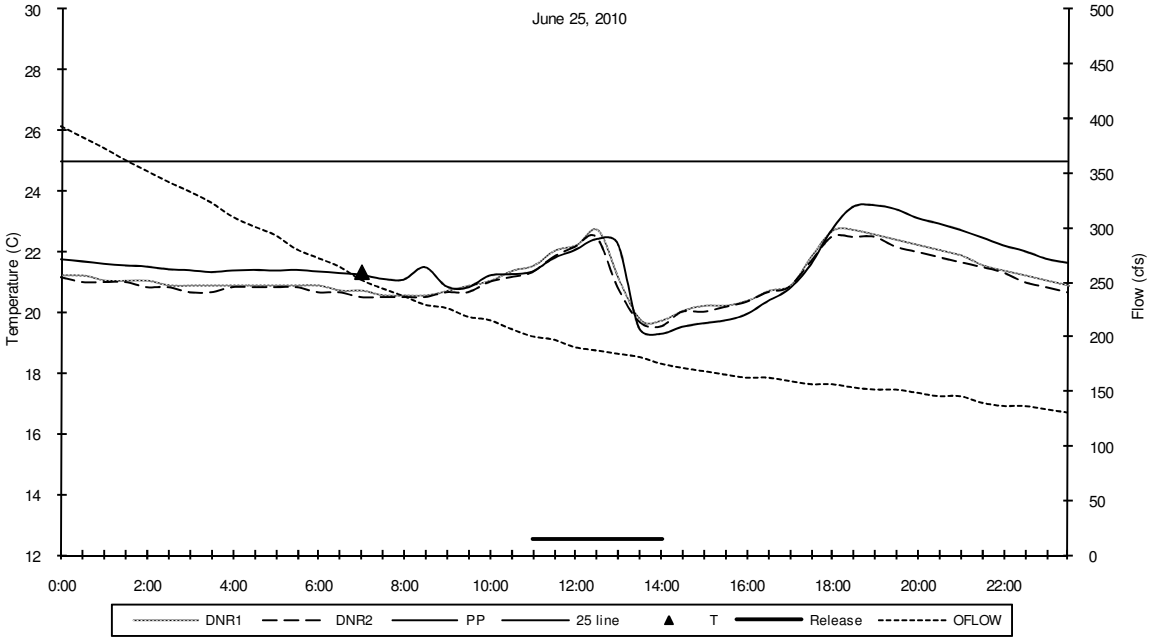
P7	P9	P11	P12	P14	P15	Temperature		PCLD	8
24.3	24.5	25.5				OFLOW	76.4	ECLD	4.9
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	85	SMAX	24.2
24.8	24.9	25.6	25.7	26.5	20.9	EMAX	30.6	SWAMAX	25.3
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.8	STIME25	
24.3	24.3	25.5				TAIR	30.6	STIMEMAX	



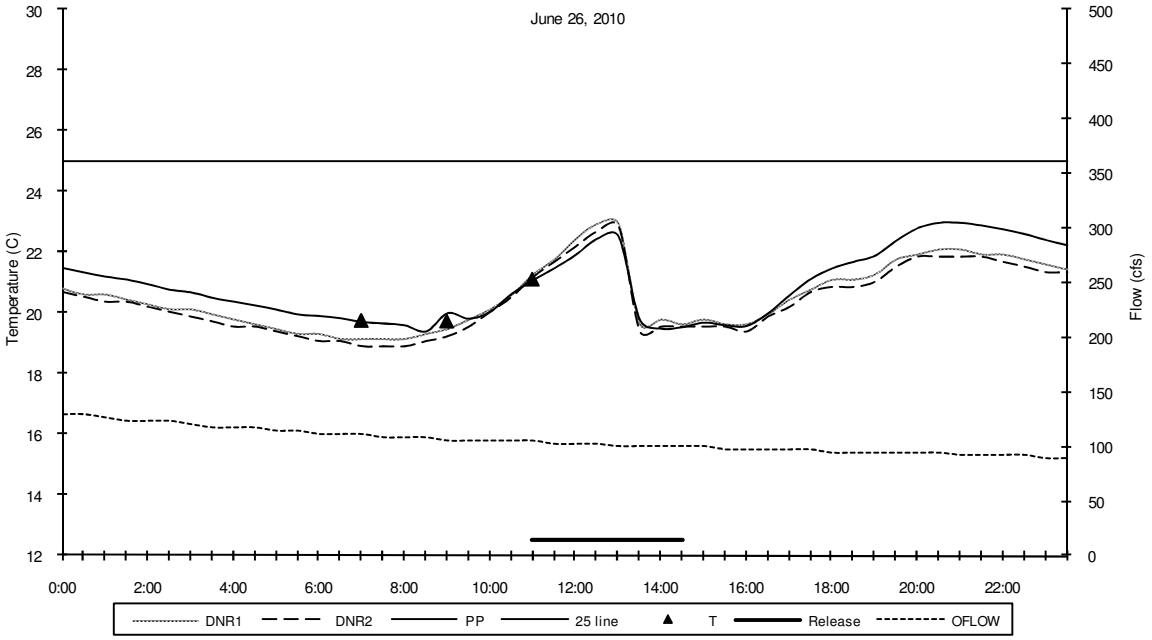
P7	P9	P11	P12	P14	P15	Temperature		PCLD	3
25.6	26					OFLOW	73	ECLD	9.2
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	88	SMAX	24.5
23.8	24.1	26.6	27.4	19.5	20.3	EMAX	30.6	SWAMAX	26.4
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.3	STIME25	
25.6	26					TAIR	31.1	STIMEMAX	



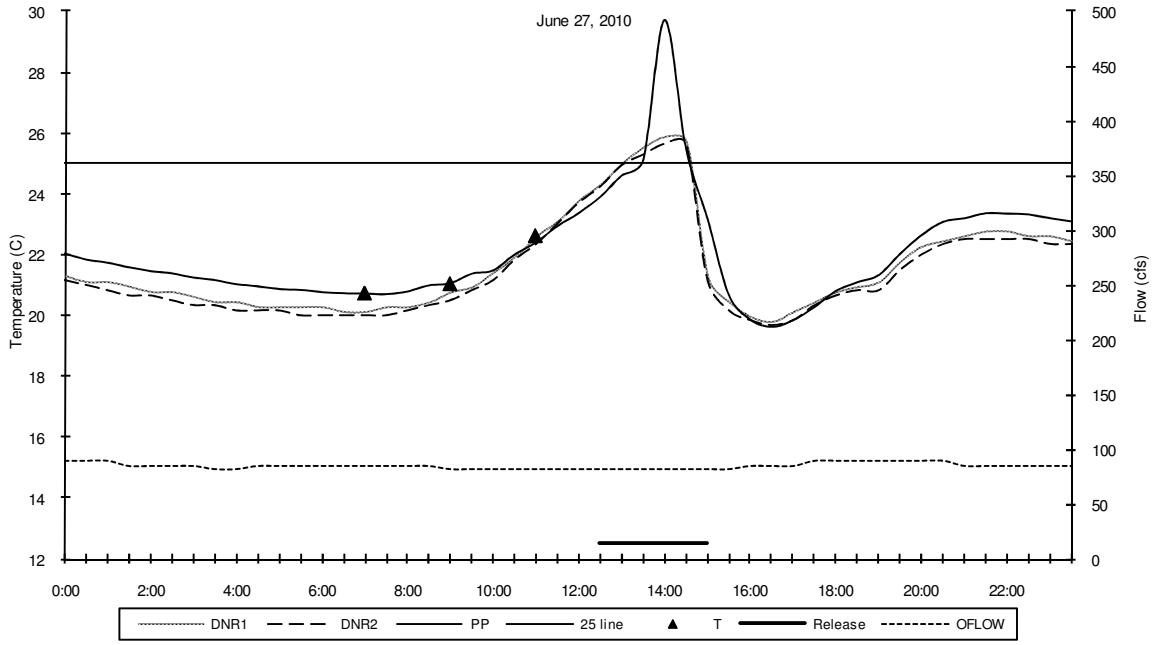
P7	P9	P11	P12	P14	P15	Temperature		PCLD	8
23.9	24.2	26.2				OFLOW	169.3	ECLD	2.6
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	93	SMAX	23.4
25	25.5	26.8	26.8	24.3	19.9	EMAX	30	SWAMAX	24.5
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	29.4	STIME25	
23.9	24.2	26.2				TAIR	29.4	STIMEMAX	



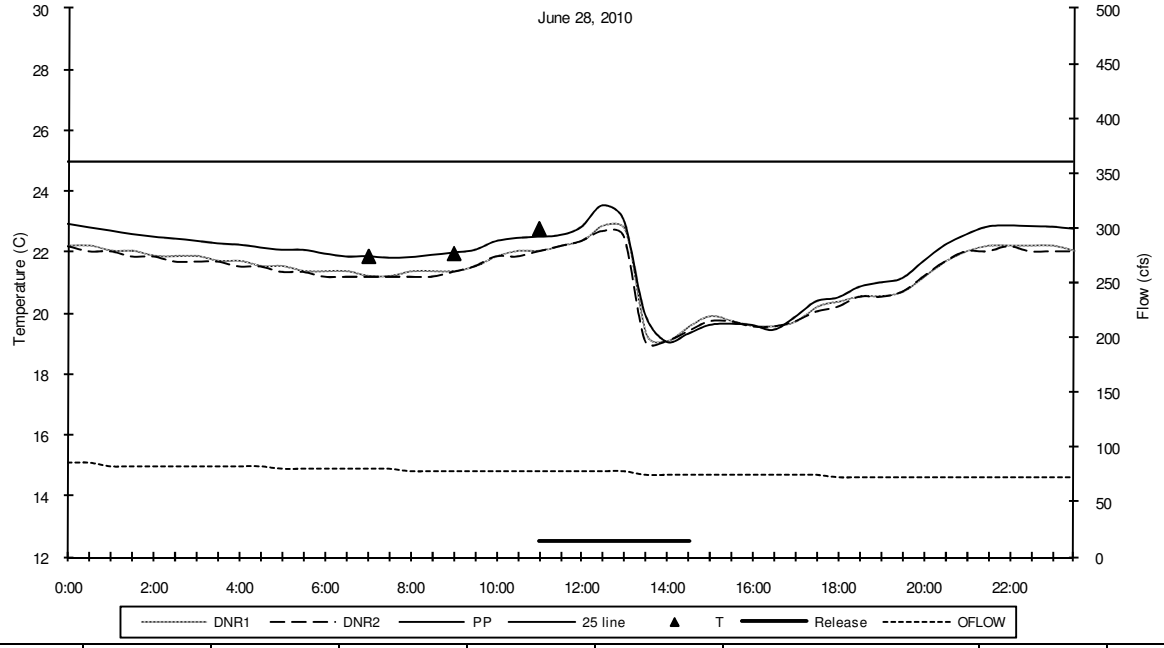
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
24.3						OFLOW	219.3	ECLD	7.2
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	293	SMAX	22.6
						EMAX	30	SWAMAX	23.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	29.4	STIME25	
						TAIR	30	STIMEMAX	



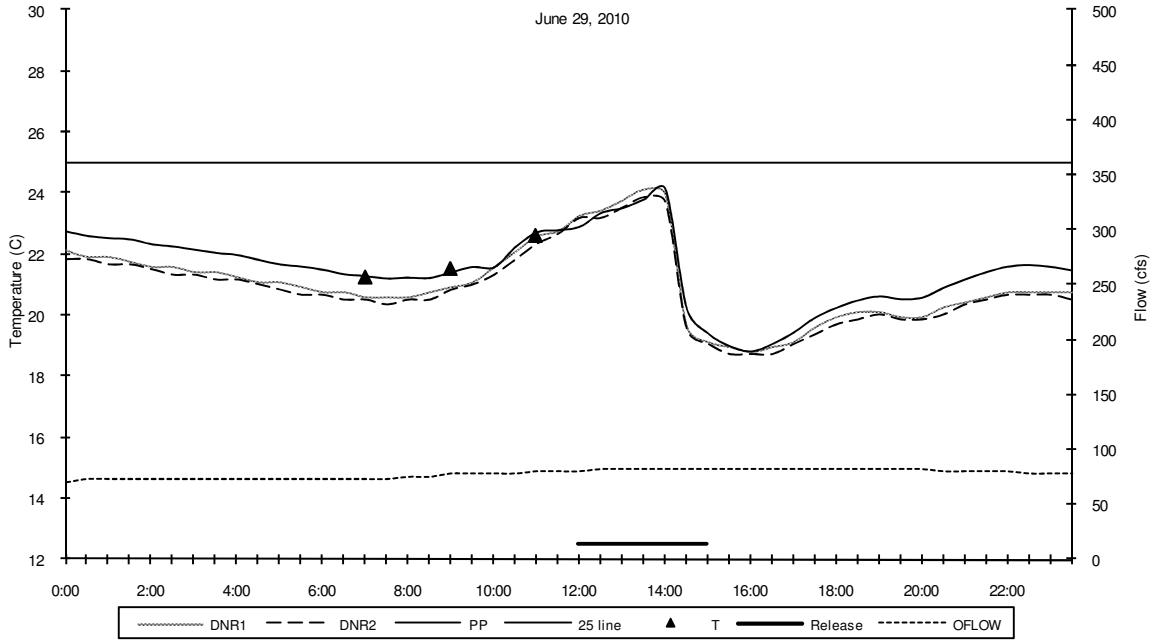
P7	P9	P11	P12	P14	P15	WhiteWater & Temperature		PCLD	6
23.8	22.4	26.3				OFLOW	105.7	ECLD	7.1
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	130	SMAX	22.9
21.5	21.8	26.3	26.2	19.8	19.9	EMAX	28.3	SWAMAX	23.9
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	26.1	STIME25	
22.6	22.4	26.3				TAIR	30	STIMEMAX	



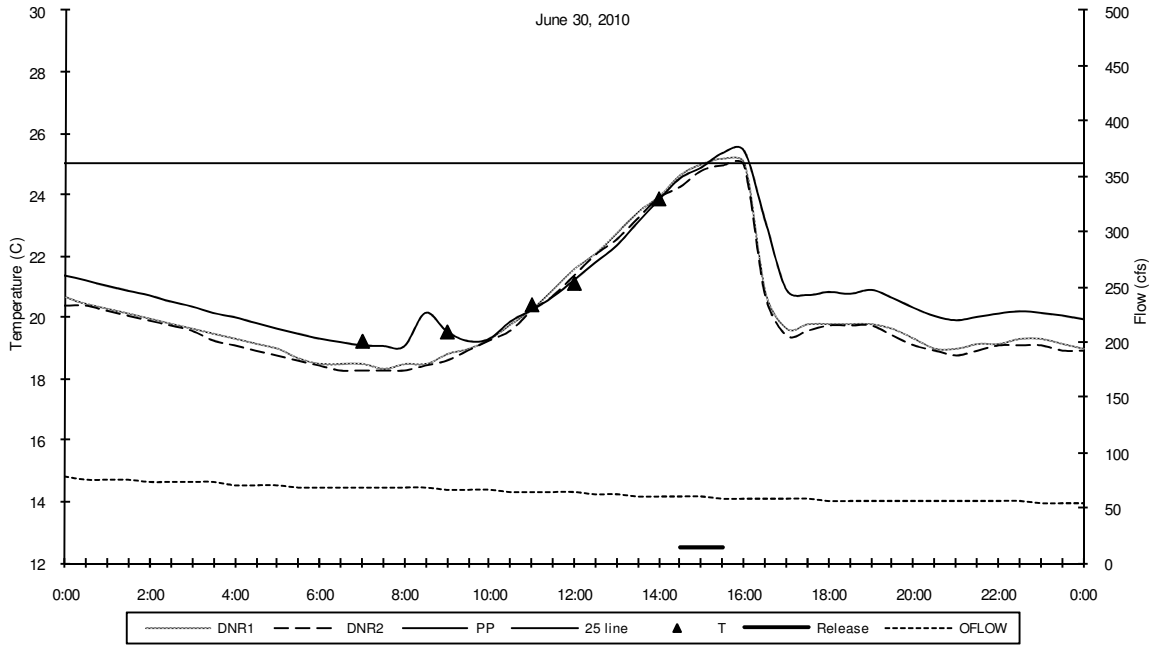
P7	P9	P11	P12	P14	P15	Temperature		PCLD	8
24.4	24.6	27.6				OFLOW	85.2	ECLD	8.4
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	98	SMAX	25.8
23.7	24.2	27.4	27.6	27.4	21.4	EMAX	31.1	SWAMAX	25.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.8	STIME25	13:30:00
24.4	24.6	27.6				TAIR	32.2	STIMEMAX	14:30:00



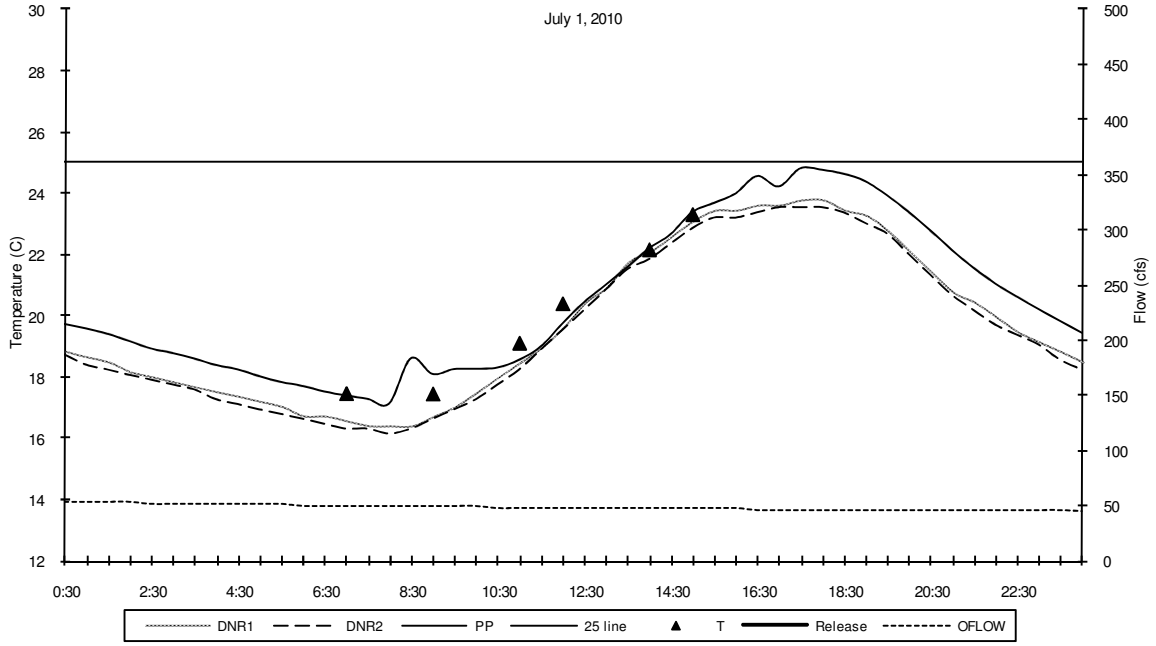
P7	P9	P11	P12	P14	P15	WhiteWater & Temperature		PCLD	10
22.7	22.8	25.4				OFLOW	77.3	ECLD	6.4
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	93	SMAX	22.8
24.8	25	26.5	26	19.2	20.2	EMAX	31.1	SWAMAX	25.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	30	STIME25	
22.7	22.8	25.4				TAIR	27.2	STIMEMAX	



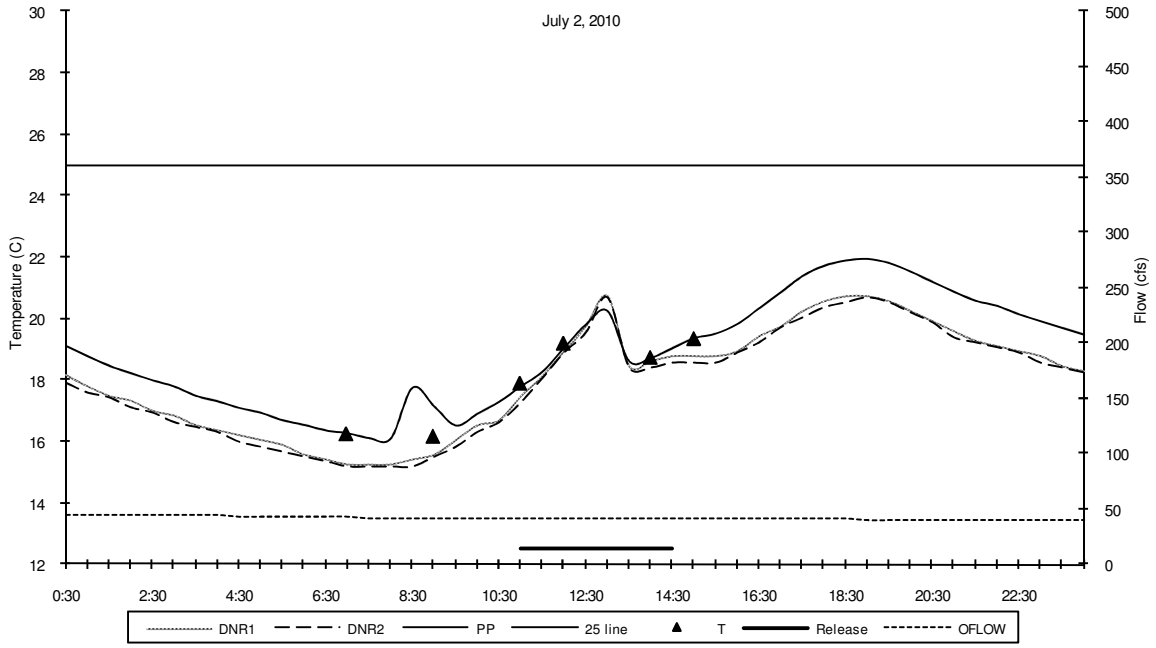
P7	P9	P11	P12	P14	P15	Temperature		PCLD	3
24.2	24.7	26.2				OFLOW	77.9	ECLD	4.4
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	85	SMAX	24
24.6	25	27.2	26.8	24.9	19	EMAX	28.9	SWAMAX	25.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.2	STIME25	
24.1	24.7	26.2				TAIR	26.1	STIMEMAX	



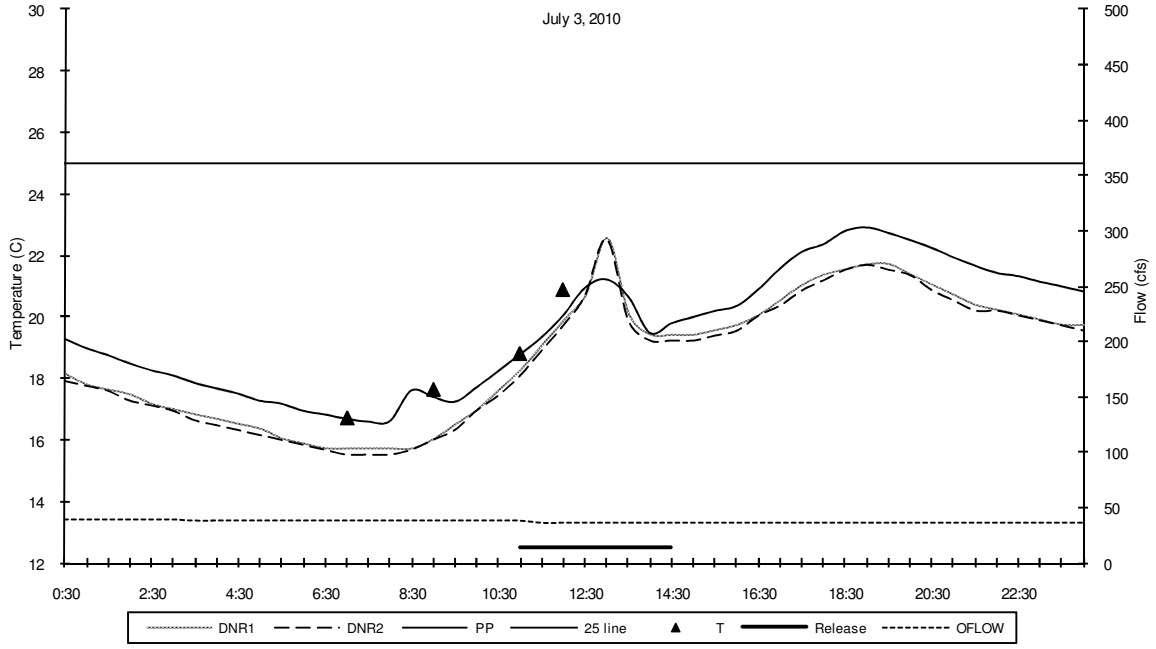
P7	P9	P11	P12	P14	P15	Temperature		PCLD	1
23	23.5	24.4	24.3	25.7		OFLOW	63.5	ECLD	9.3
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	82	SMAX	25.1
22.2	22.3	24.8	25.1	25.9	26.1	EMAX	27.2	SWAMAX	24.3
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	24.4	STIME25	15:30:00
23	23.5	24.4	24.3	25.7		TAIR	23.9	STIMEMAX	15:30:00



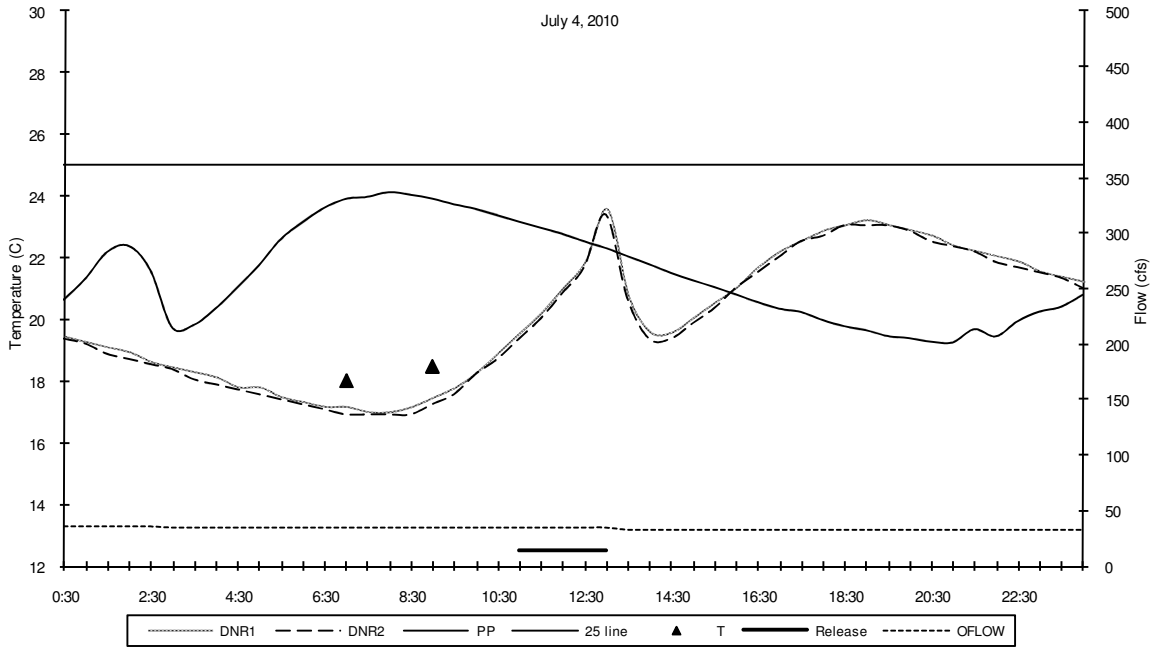
P7	P9	P11	P12	P14	P15			PCLD	1
22.7	22.7	23.8	24.1	23.7	24.4	OFLOW	48.9	ECLD	4.4
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	62	SMAX	23.7
22.3	22.5	23.5	23.7	24	24.3	EMAX	23.3	SWAMAX	22.9
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX		STIME25	
22.7	22.7	23.8	24.1	23.7	24.4	TAIR	22.2	STIMEMAX	



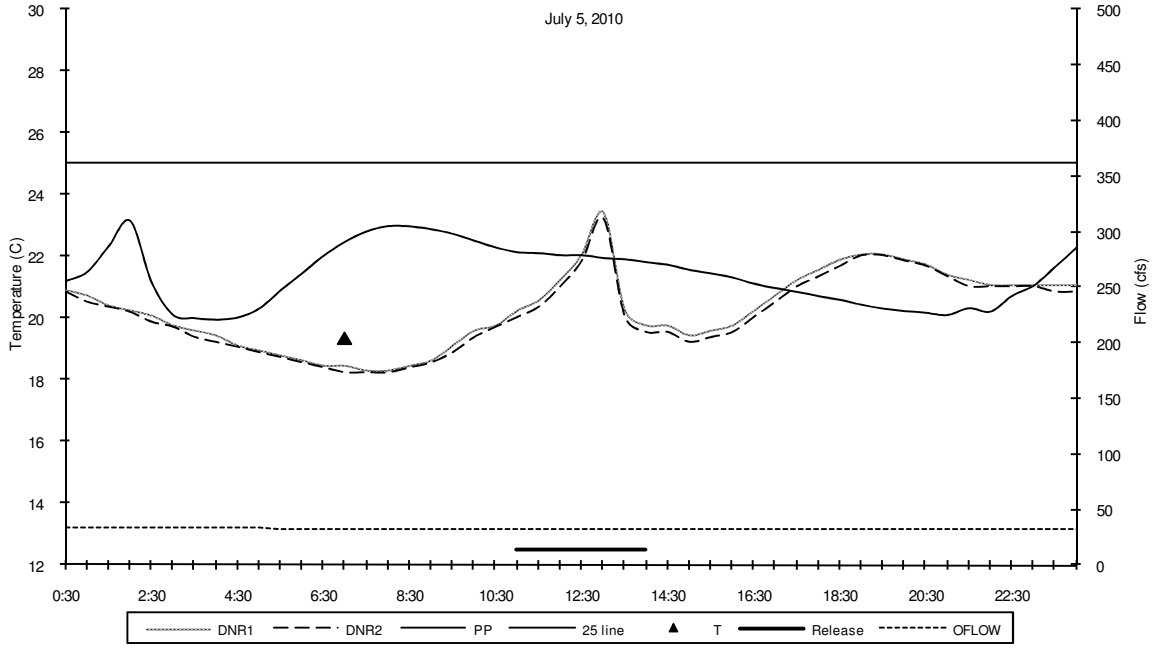
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	1
23.5	23.2	23.9	24	20	20.4	OFLOW	41.5	ECLD	5.2
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	53	SMAX	20.7
22.7	22.7	23.5	23.8	19.9	19.7	EMAX	25	SWAMAX	23.2
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	21.7	STIME25	
23.5	23.2	23.9	24	20	20.4	TAIR	25	STIMEMAX	



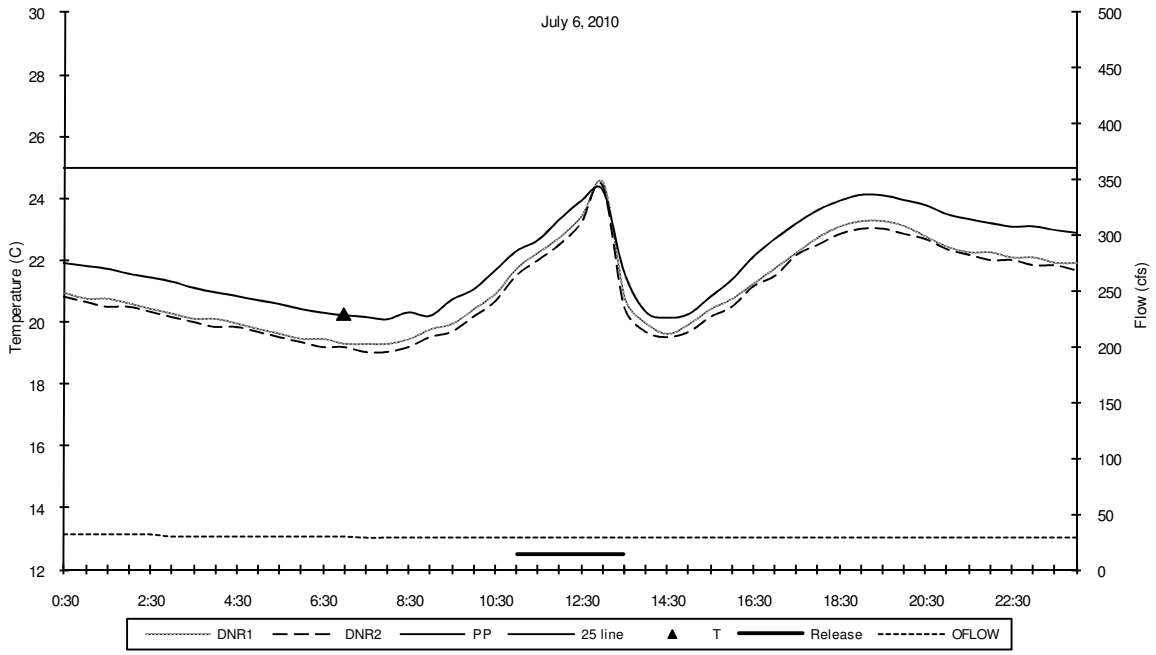
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
25.2	25.9	24.7	25.8			OFLOW	37.1	ECLD	4.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	36	SMAX	22.6
25.1	25.1	25.3	25.5	20.9	20.4	EMAX	29.4	SWAMAX	25
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	22.8	STIME25	
25.1	25.9	24.7	25.8			TAIR	29.4	STIMEMAX	



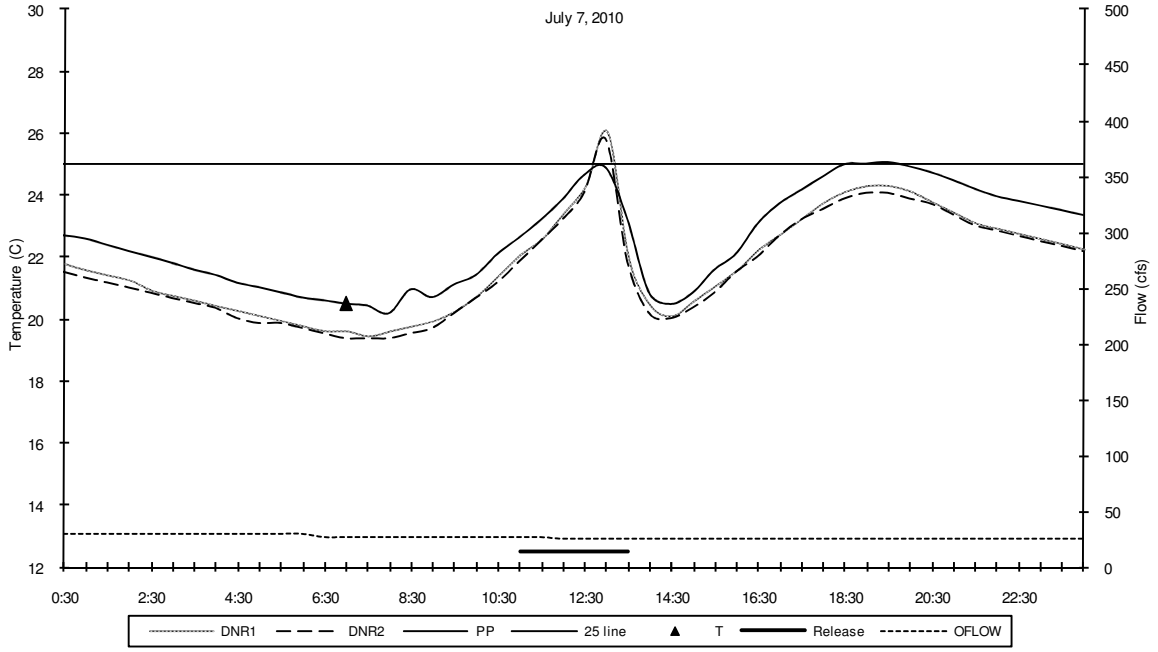
P7	P9	P11	P12	P14	P15	Temperature		PCLD	6
26.1	26.3					OFLOW	34.4	ECLD	2.8
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	33	SMAX	23.5
26.1	26.2	26.3	26.3	20.5	20.8	EMAX	30	SWAMAX	26.4
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.8	STIME25	
26.1	26.3					TAIR	30.6	STIMEMAX	



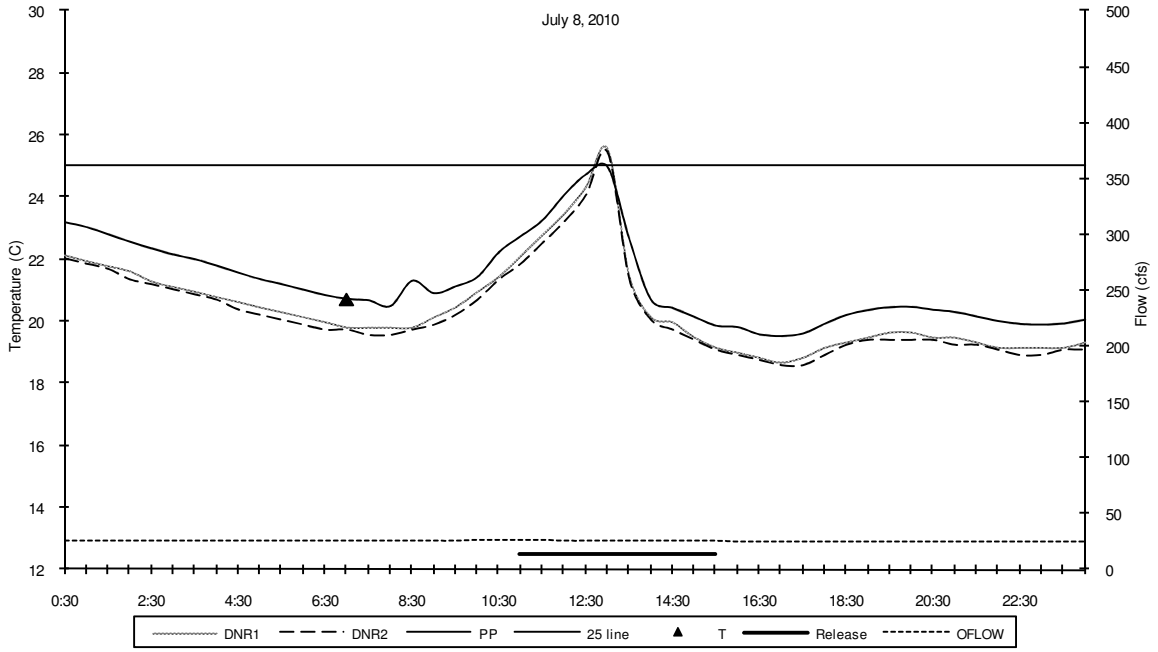
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
27.1						OFLOW	32.3	ECLD	3.9
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	32	SMAX	23.3
27	27	26.5	26.3	20.8	20.1	EMAX	31.7	SWAMAX	27.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.9	STIME25	
27.1						TAIR	32.3	STIMEMAX	



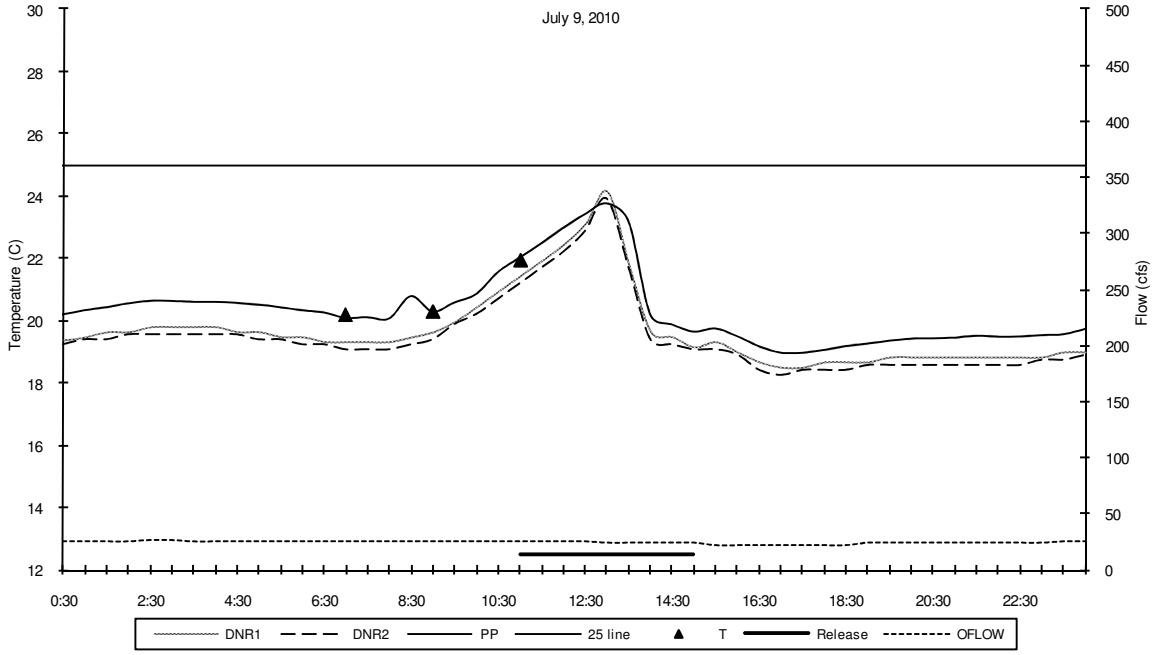
P7	P9	P11	P12	P14	P15	Temperature		PCLD	6
27.8						OFLOW	29.5	ECLD	5.8
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	29	SMAX	24.5
27.4	27.6	27.8	27.5	20.2	20.2	EMAX	32.8	SWAMAX	28.9
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	30.6	STIME25	
27.8						TAIR	33.3	STIMEMAX	



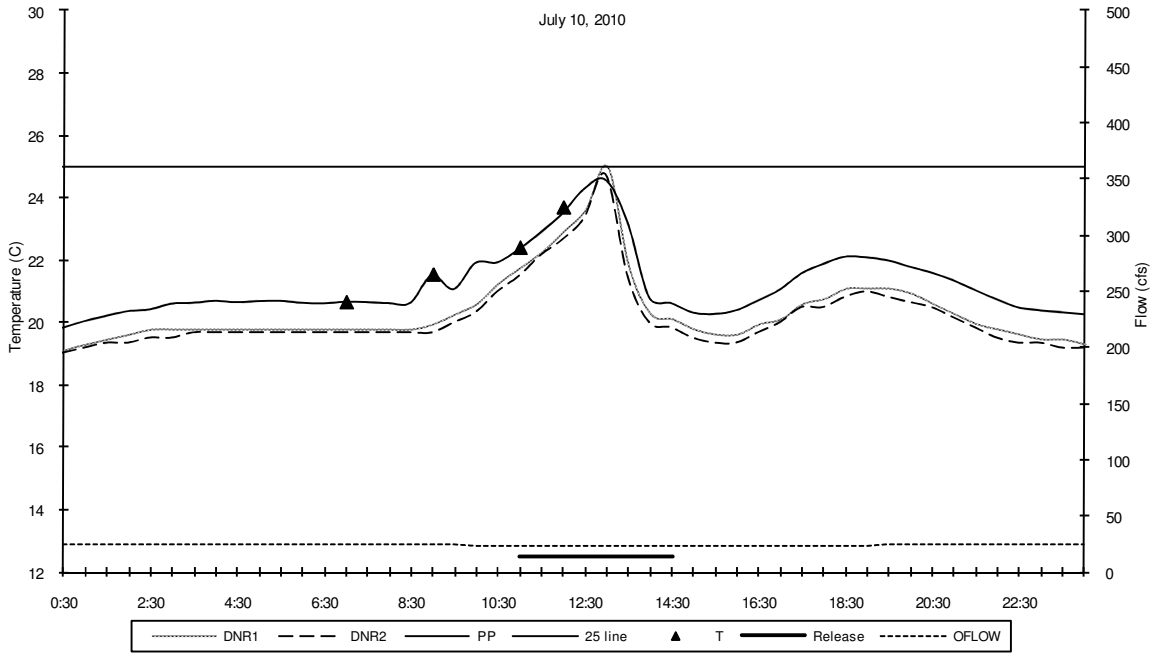
P7	P9	P11	P12	P14	P15	Temperature		PCLD	6
27.9						OFLOW	27	ECLD	4.7
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	27	SMAX	25.9
27.7	27.8	28.3	28.2	20.5	20.8	EMAX	32.8	SWAMAX	29.5
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	31.7	STIME25	13:00:00
27.9						TAIR	33.3	STIMEMAX	13:00:00



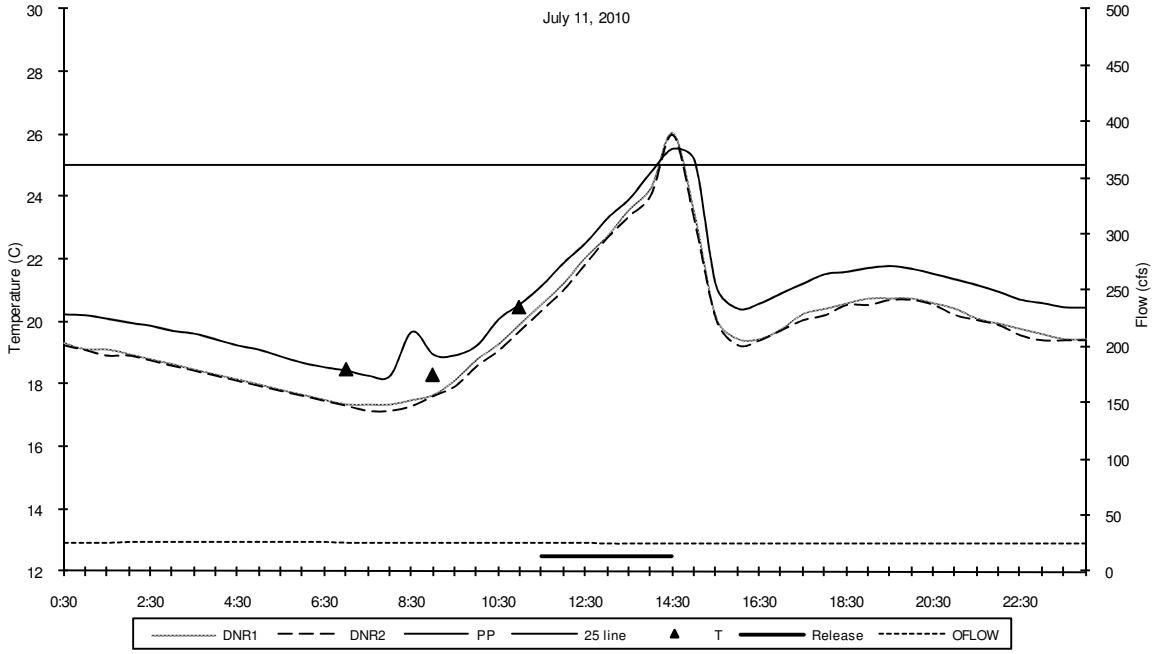
P7	P9	P11	P12	P14	P15	Temperature & Power		PCLD	6
28						OFLOW	25.8	ECLD	2.3
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	25	SMAX	25.5
28.1	28.2	28.3	28.3	20.2	19.5	EMAX	32.8	SWAMAX	29.6
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	32.2	STIME25	13:00:00
28						TAIR	33.3	STIMEMAX	13:00:00



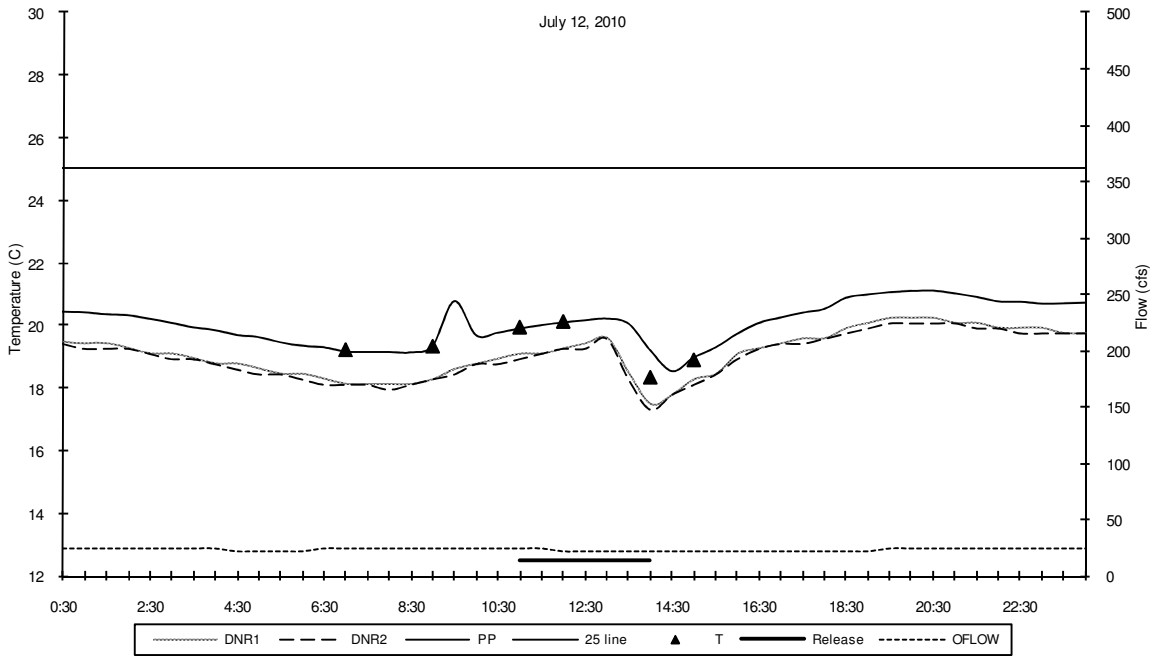
P7	P9	P11	P12	P14	P15	WhiteWater & Temperature		PCLD	10
25.2	25.1	26.1				OFLOW	24.3	ECLD	3
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	25	SMAX	24
27.6	27.8	27.6	27.3	19.9	19.5	EMAX	32.2	SWAMAX	29.6
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	31.7	STIME25	
25.1	25.1	26.1				TAIR	28.9	STIMEMAX	



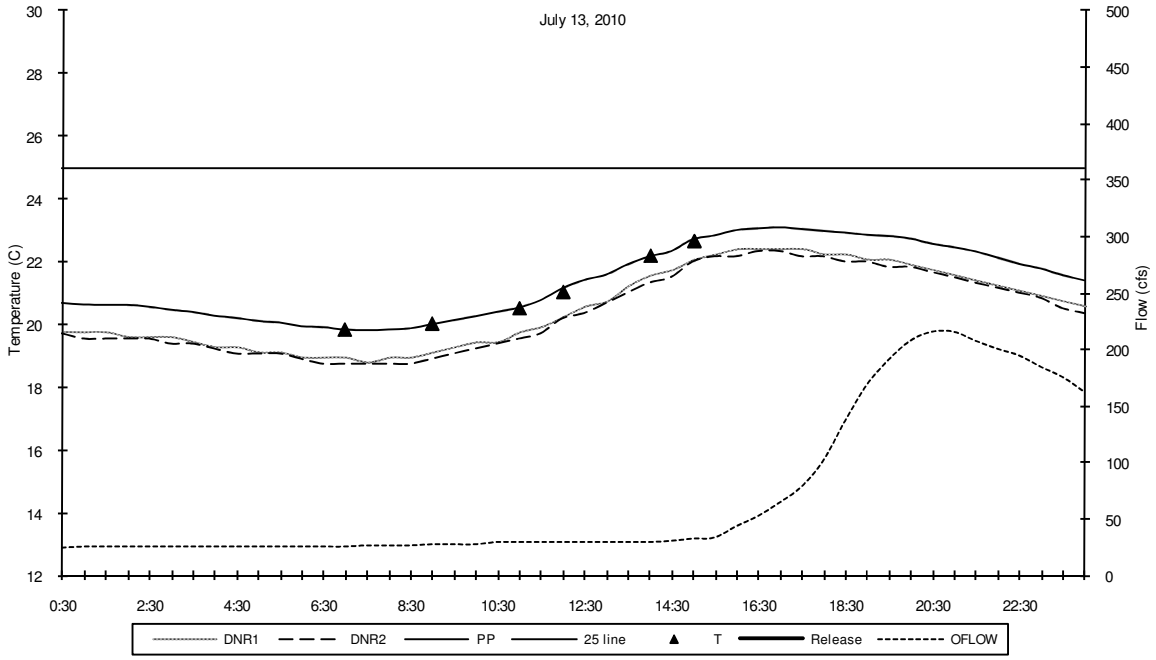
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	10
24.4	25.5	25	25.8			OFLOW	24.6	ECLD	9.3
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	25	SMAX	24.9
26.2	26	26.9	26.9	20.5	19.9	EMAX	31.7	SWAMAX	28.3
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	30.6	STIME25	
24.4	25.5	25	25.8			TAIR	26.1	STIMEMAX	



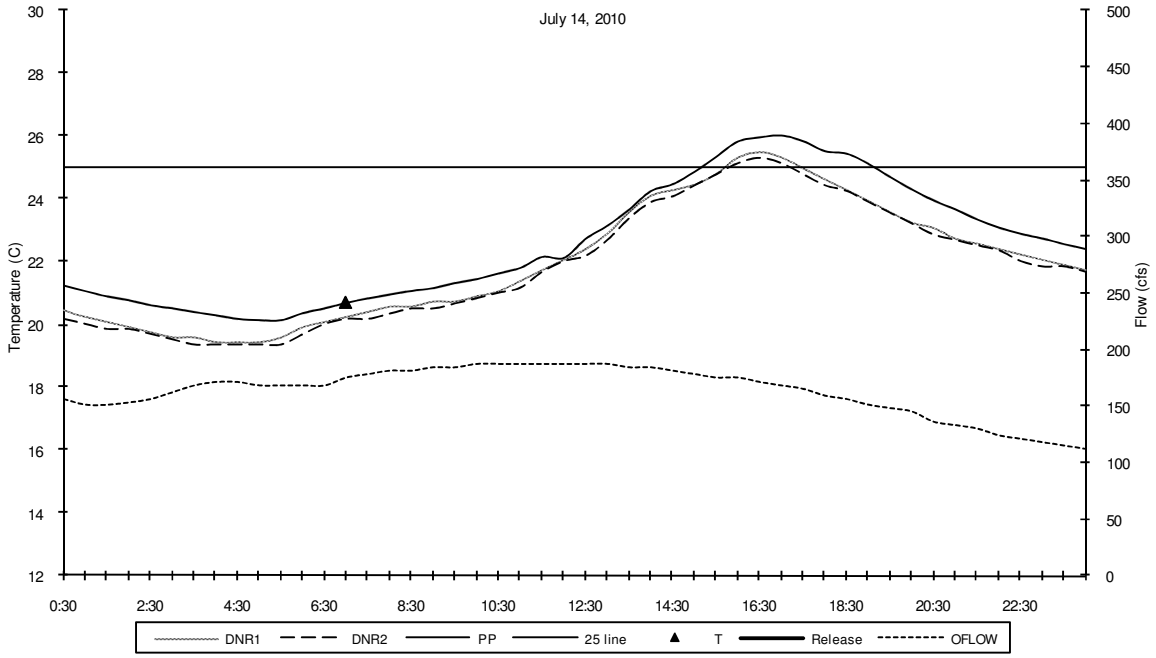
P7	P9	P11	P12	P14	P15	Temperature & Power		PCLD	8
25.1	24.6	25.9				OFLOW	24.8	ECLD	4.8
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	20	SMAX	26
25.6	25.7	26.1	26	26.7	24.5	EMAX	28.9	SWAMAX	28.5
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	26.1	STIME25	14:30:00
25.1	24.6	25.9				TAIR	28.3	STIMEMAX	14:30:00



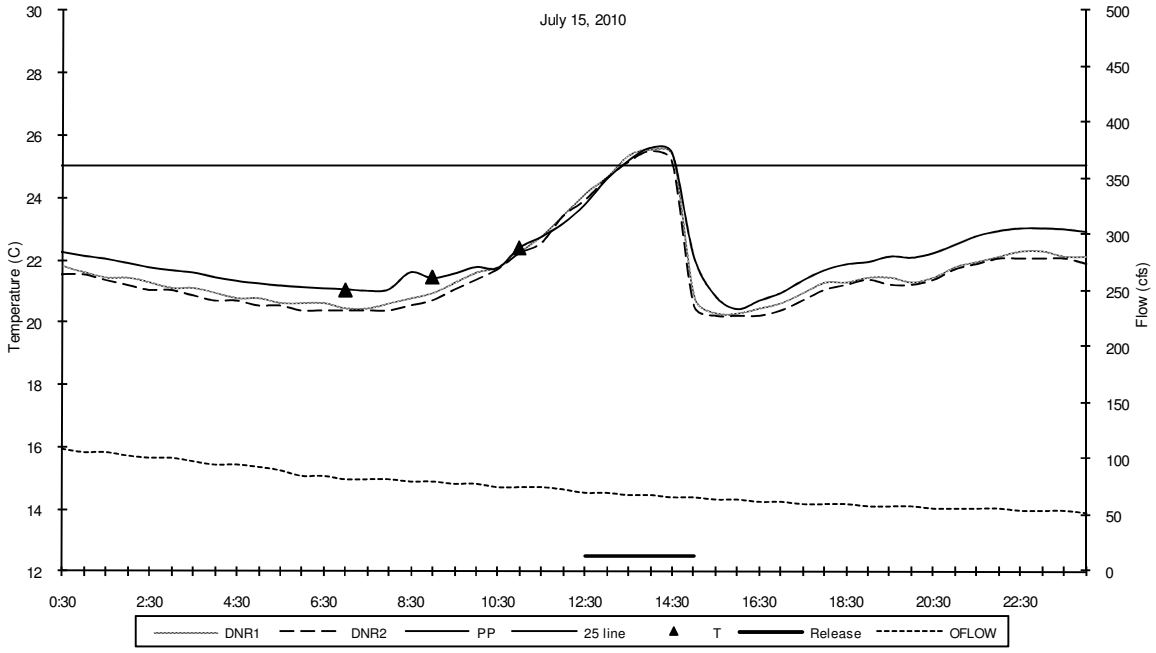
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	10
23.6	23.6	23.1	22.8	19	19.7	OFLOW	23.2	ECLD	2.8
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	22	SMAX	20.2
26.2	26.2	24.6	23.9	18.6	19.2	EMAX	28.9	SWAMAX	26
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.3	STIME25	
23.6	23.6	23.1	22.7	19	19.6	TAIR	25	STIMEMAX	



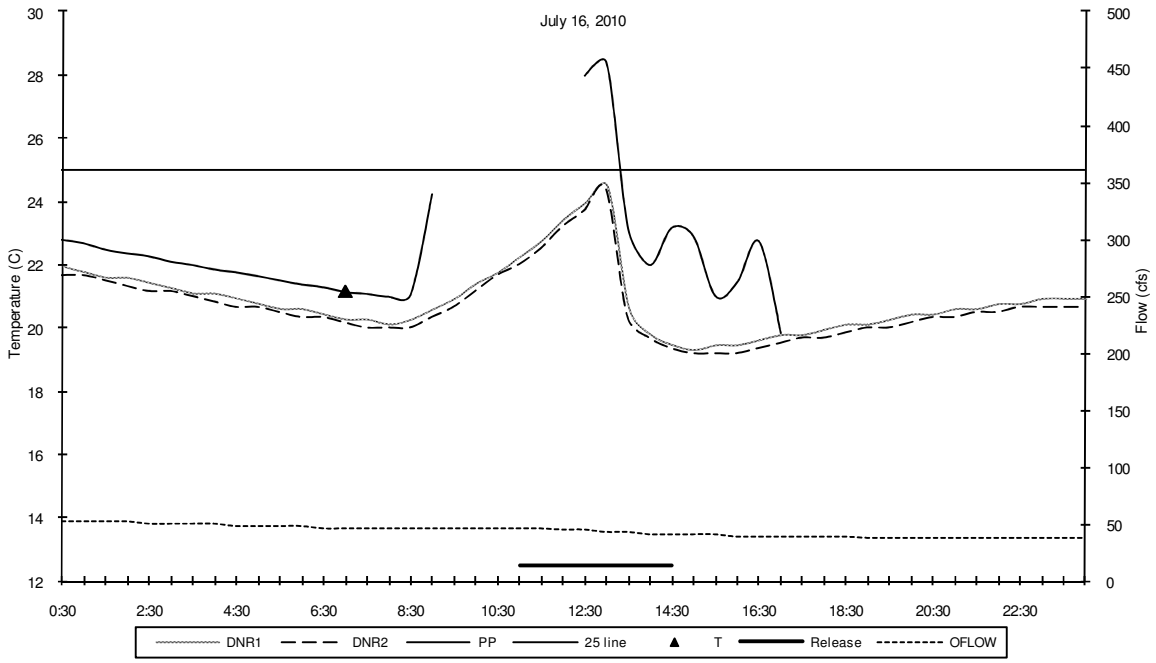
P7	P9	P11	P12	P14	P15			PCLD	8
25.2	25.3	24.3	24.2	23.9	23.7	OFLOW	69.2	ECLD	4.7
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	25	SMAX	22.4
25.6	25.8	24.4	24.1	23.3	23.2	EMAX	27.2	SWAMAX	24.6
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	25.6	STIME25	
25.2	25.3	24.3	24.2	23.9	23.7	TAIR	27.2	STIMEMAX	



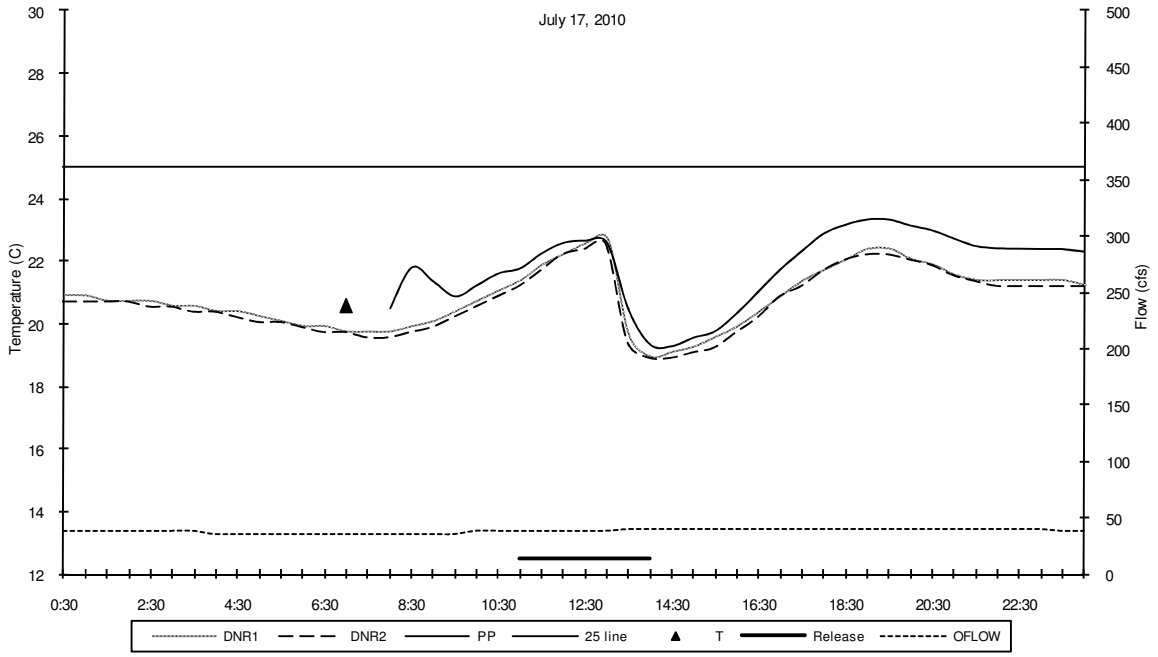
P7	P9	P11	P12	P14	P15			PCLD	8
23.3						OFLOW	163.9	ECLD	9.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	168	SMAX	25.4
						EMAX	27.2	SWAMAX	23.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.2	STIME25	16:00:00
						TAIR	28.9	STIMEMAX	16:30:00



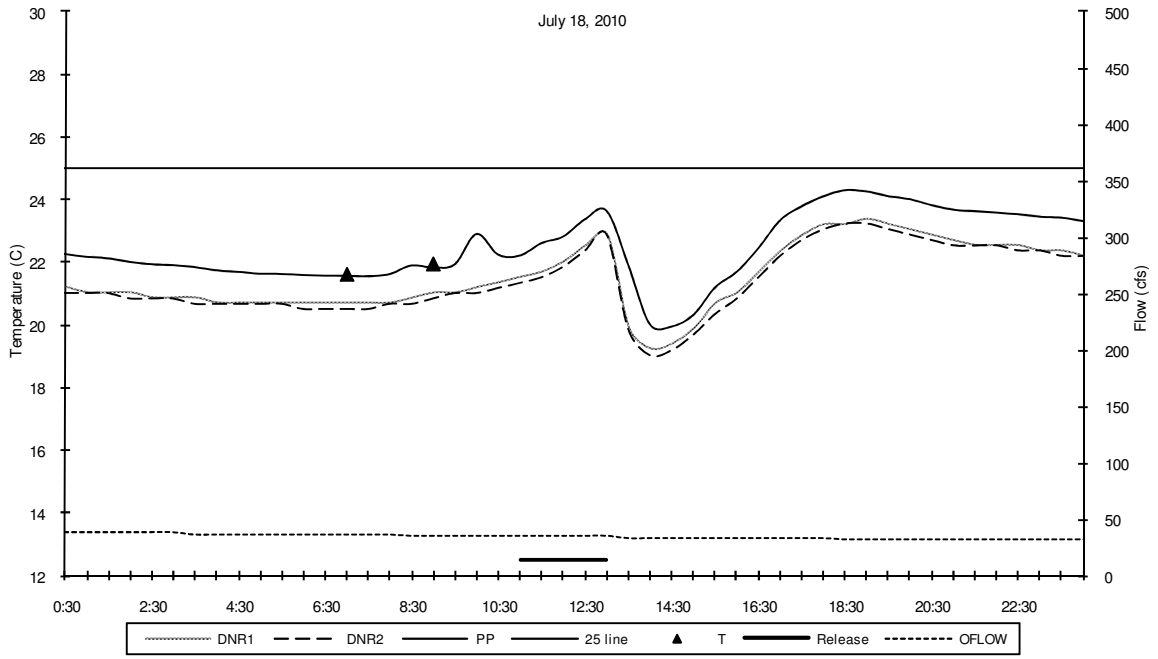
P7	P9	P11	P12	P14	P15	Temperature		PCLD	6
25	25.4	26.9				OFLOW	75.6	ECLD	8.3
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	90	SMAX	25.5
23.8	24.1	26.7	26.9	27.2	20.8	EMAX	30	SWAMAX	25.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	26.7	STIME25	13:30:00
25	25.4	26.9				TAIR	31.1	STIMEMAX	14:00:00



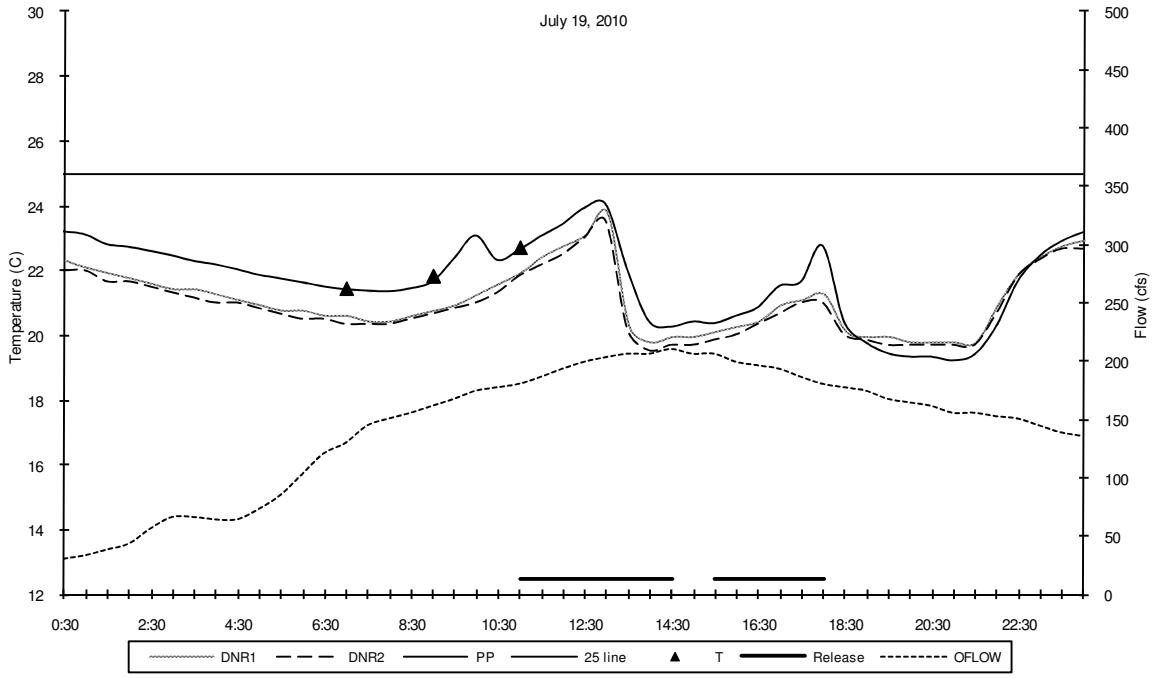
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
26.5						OFLOW	43.9	ECLD	4.2
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	48	SMAX	24.5
26.4	26.6	27.3	27.4	19.4	19.2	EMAX	30	SWAMAX	26.5
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	29.4	STIME25	
26.5						TAIR	30.6	STIMEMAX	



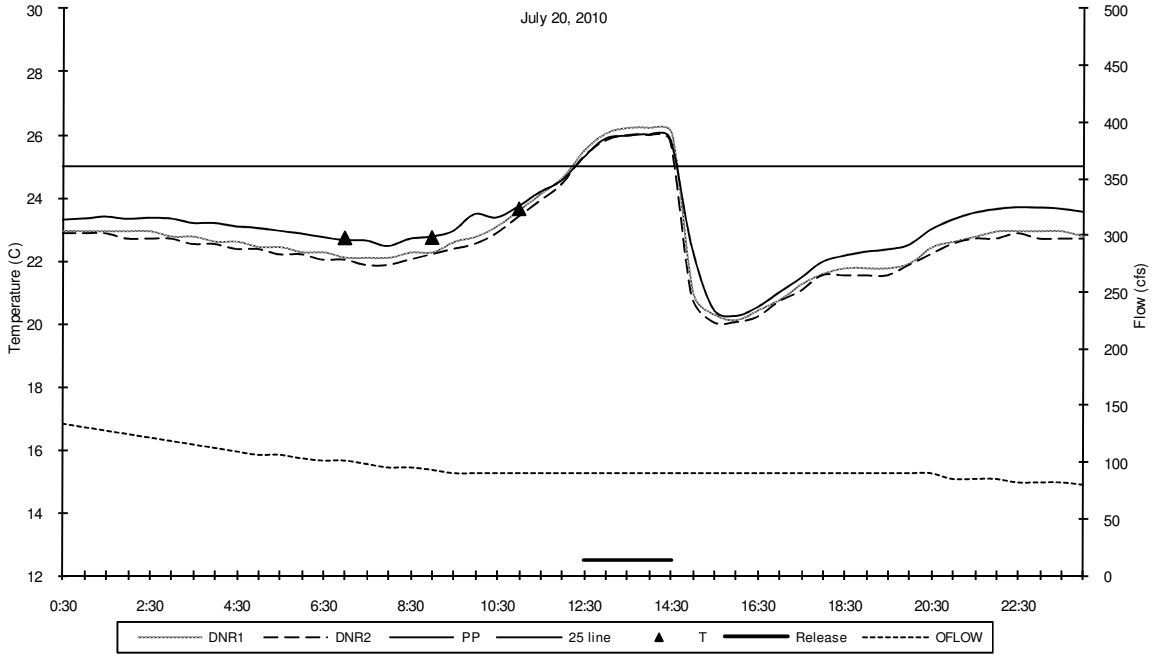
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
26.4						OFLOW	37.9	ECLD	5.4
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	36	SMAX	22.6
26.5	26.6	26.4	26.3	19	19.5	EMAX	30	SWAMAX	26.7
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	29.4	STIME25	
27						TAIR	31.1	STIMEMAX	



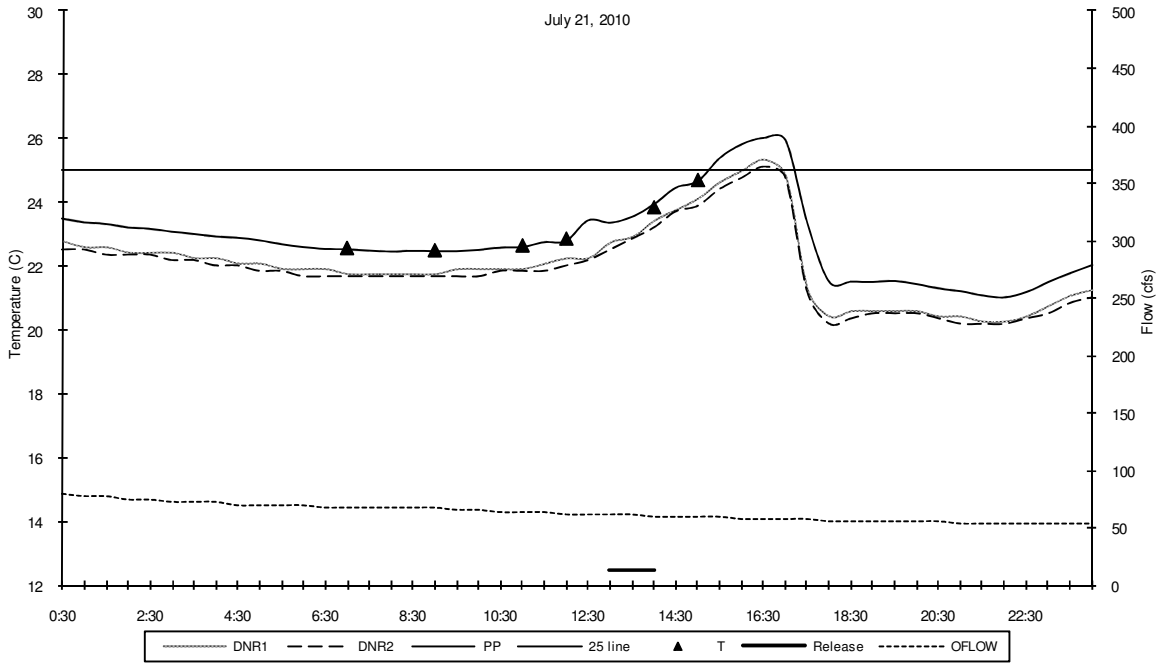
P7	P9	P11	P12	P14	P15	Temperature		PCLD	8
26.3	26.6					OFLOW	34.5	ECLD	7.6
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	36	SMAX	23.3
26	26.4	25.4	25.3	19.4	20.3	EMAX	29.4	SWAMAX	26.5
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.3	STIME25	
26.2	26.6					TAIR	29.4	STIMEMAX	



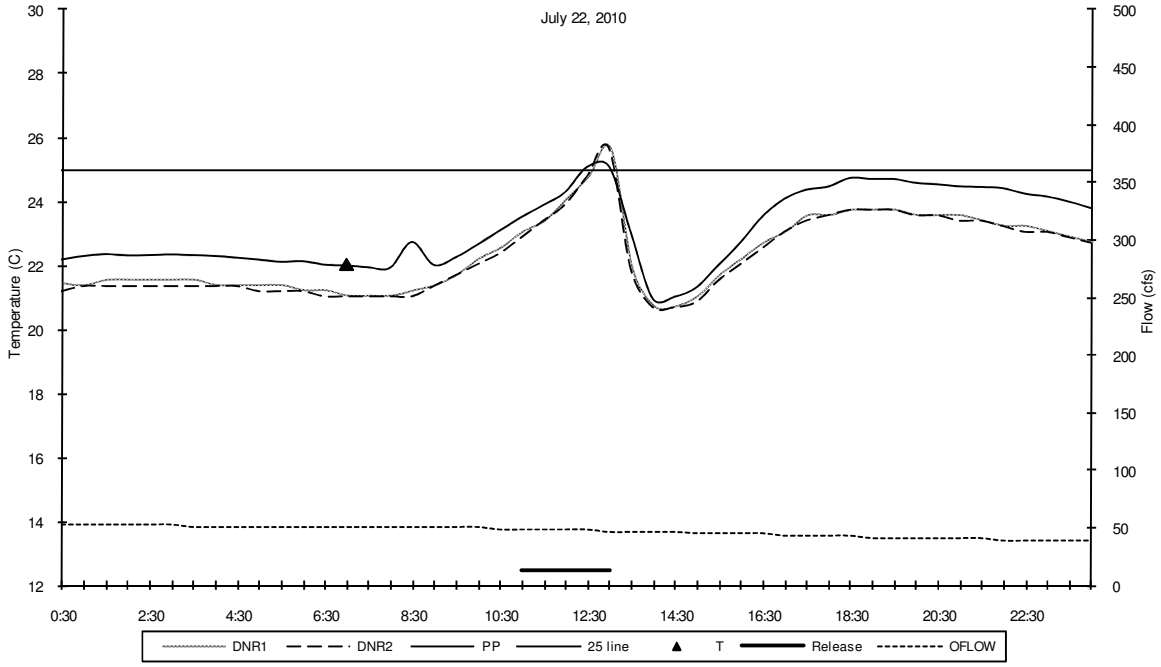
P7	P9	P11	P12	P14	P15	WhiteWater&Temperature&Power		PCLD	8
24.7	25.1	26.5				OFLOW	143.2	ECLD	8.6
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	78	SMAX	23.7
24	24.2	26.1	26	19.7	20.1	EMAX	29.4	SWAMAX	25.7
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.8	STIME25	
24.7	25.1	26.5				TAIR	30	STIMEMAX	



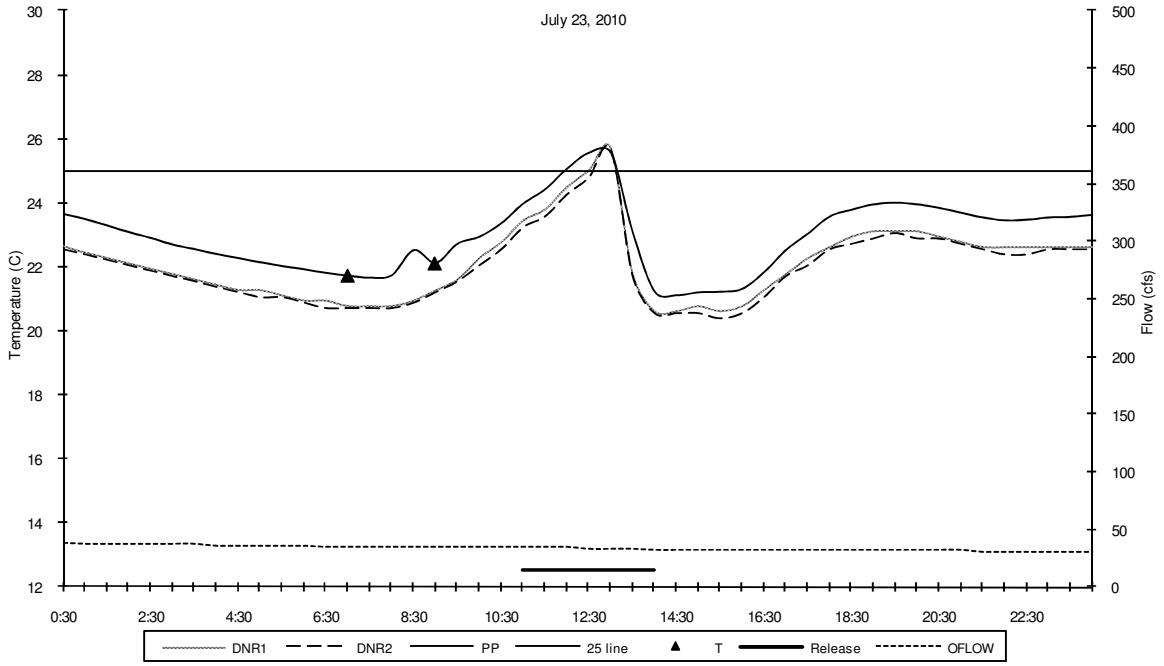
P7	P9	P11	P12	P14	P15	Temperature		PCLD	10
23.2	23	26.5				OFLOW	97.4	ECLD	8.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	106	SMAX	26.1
23.1	23.4	26.8	27.1	27.2	20.6	EMAX	28.3	SWAMAX	25.3
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.8	STIME25	12:30:00
23	23	26.5				TAIR	28.9	STIMEMAX	13:30:00



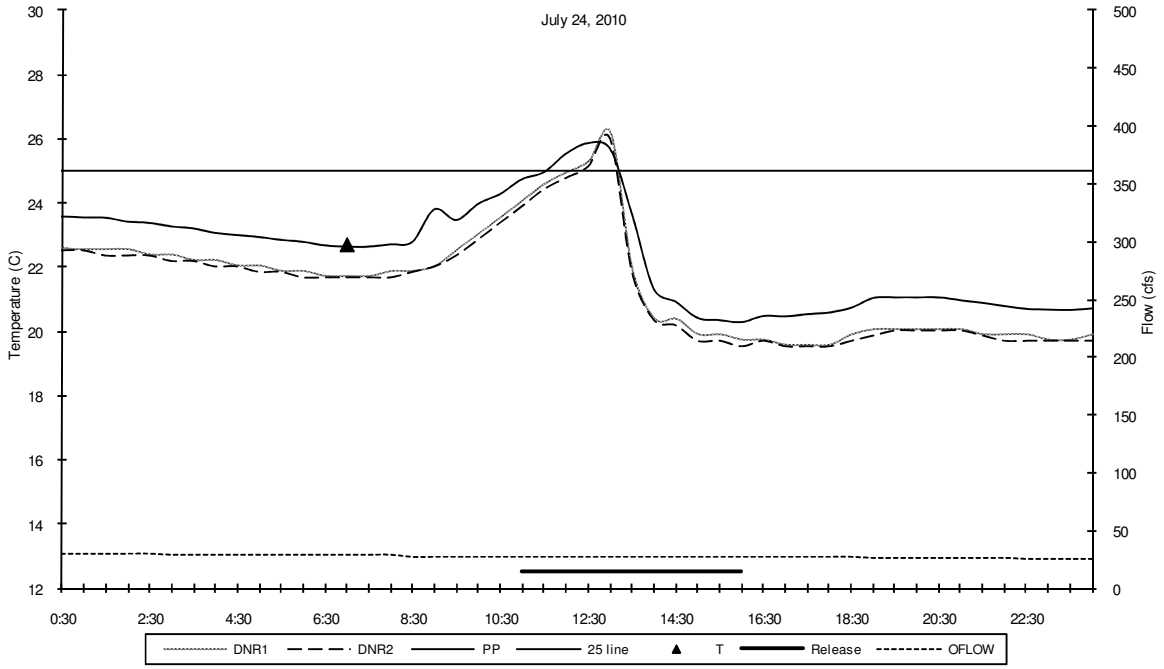
P7	P9	P11	P12	P14	P15	Temperature		PCLD	10
24.2	24.1	25.1	24.9	25.1	25.5	OFLOW	64	ECLD	9.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	70	SMAX	25.2
23.9	23.9	24.7	24.5	24.8	24.9	EMAX	27.8	SWAMAX	25
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX		STIME25	16:30:00
24.2	24.1	25.1	24.9	25.1	25.5	TAIR	28.3	STIMEMAX	16:30:00



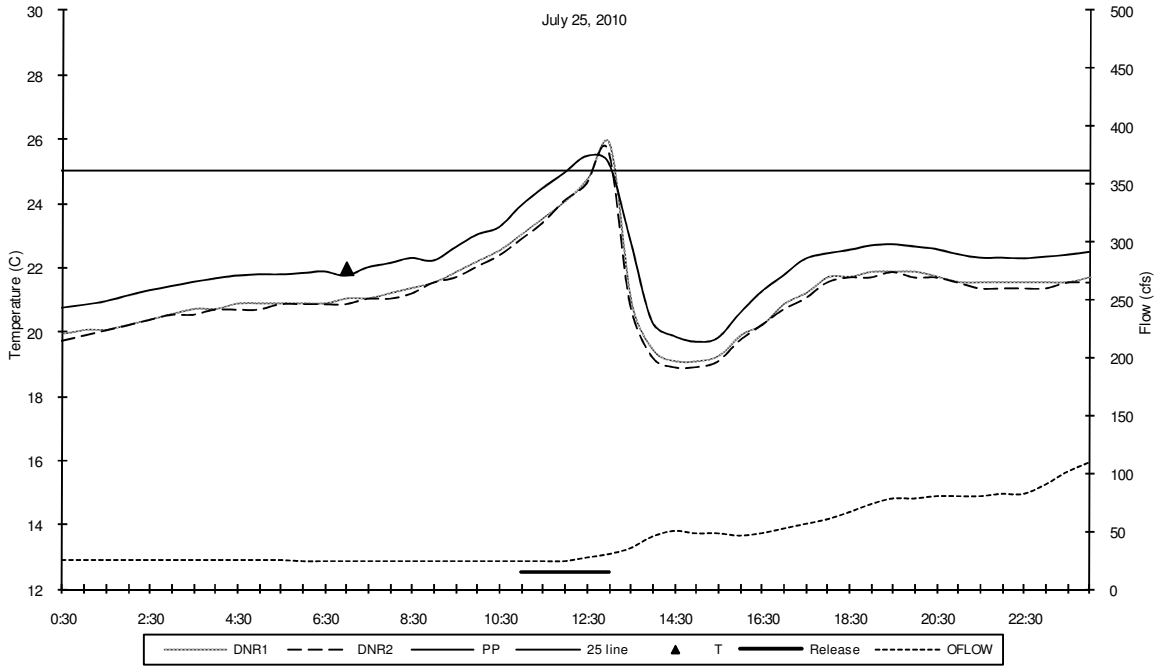
P7	P9	P11	P12	P14	P15	Temperature		PCLD	1
27						OFLOW	46.7	ECLD	7.2
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	50	SMAX	25.7
25.9	26.3	27.4	27.4	20.3	21	EMAX	30	SWAMAX	26.9
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX		STIME25	13:00:00
27						TAIR	29.4	STIMEMAX	13:00:00



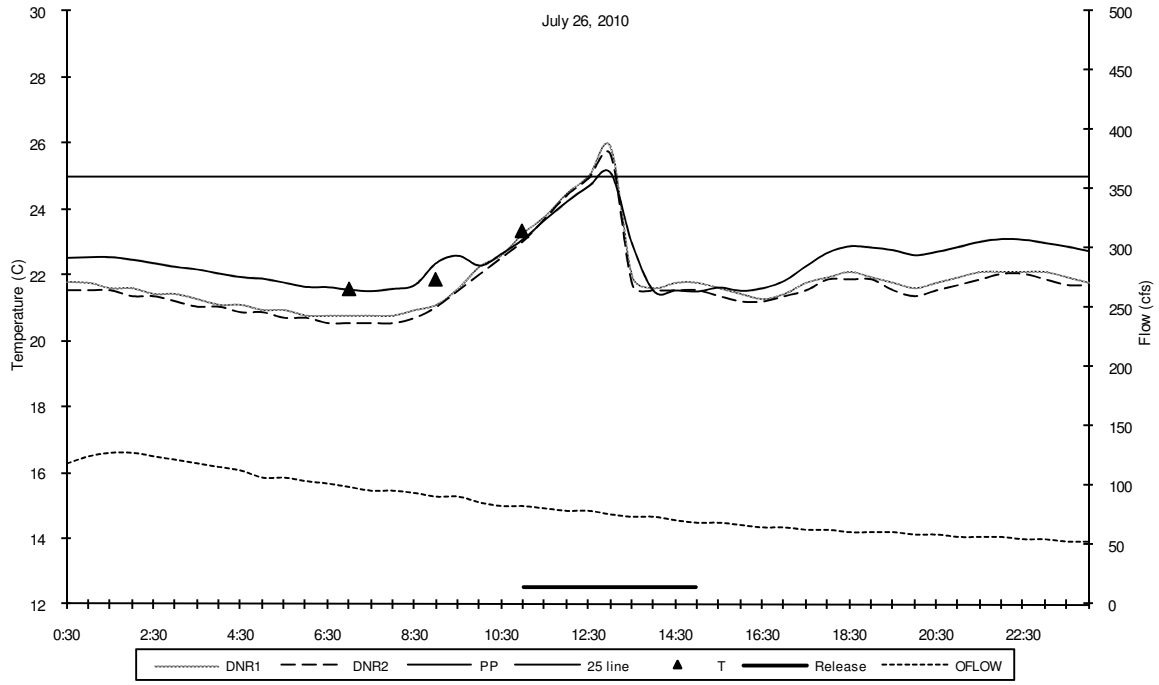
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	10
26.3	26.6					OFLOW	34	ECLD	7.6
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	36	SMAX	25.7
26.6	27.1	28.2	28	20	20.5	EMAX	31.1	SWAMAX	28.7
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	29.4	STIME25	13:00:00
26.3	26.6					TAIR	31.7	STIMEMAX	13:00:00



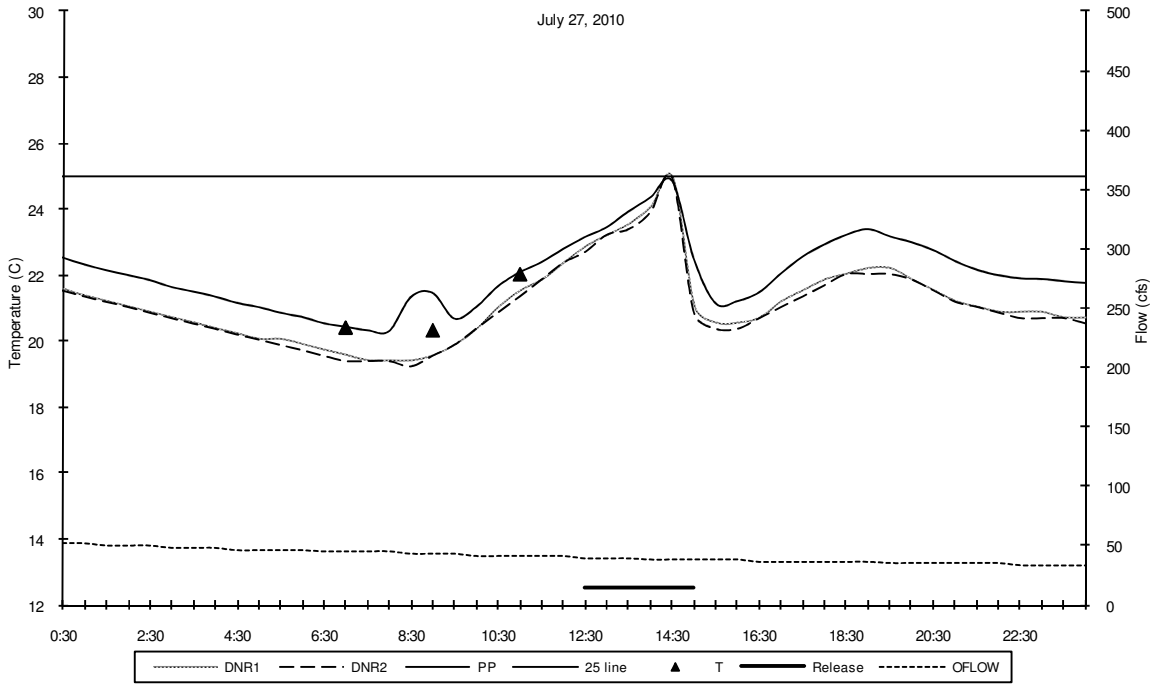
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
28.5						OFLOW	27.6	ECLD	8.8
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	29	SMAX	26.1
28.7	27	27.3	28.4	28.2	19.6	EMAX	31.7	SWAMAX	29.5
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	30.6	STIME25	12:30:00
28.5						TAIR	32.8	STIMEMAX	13:00:00



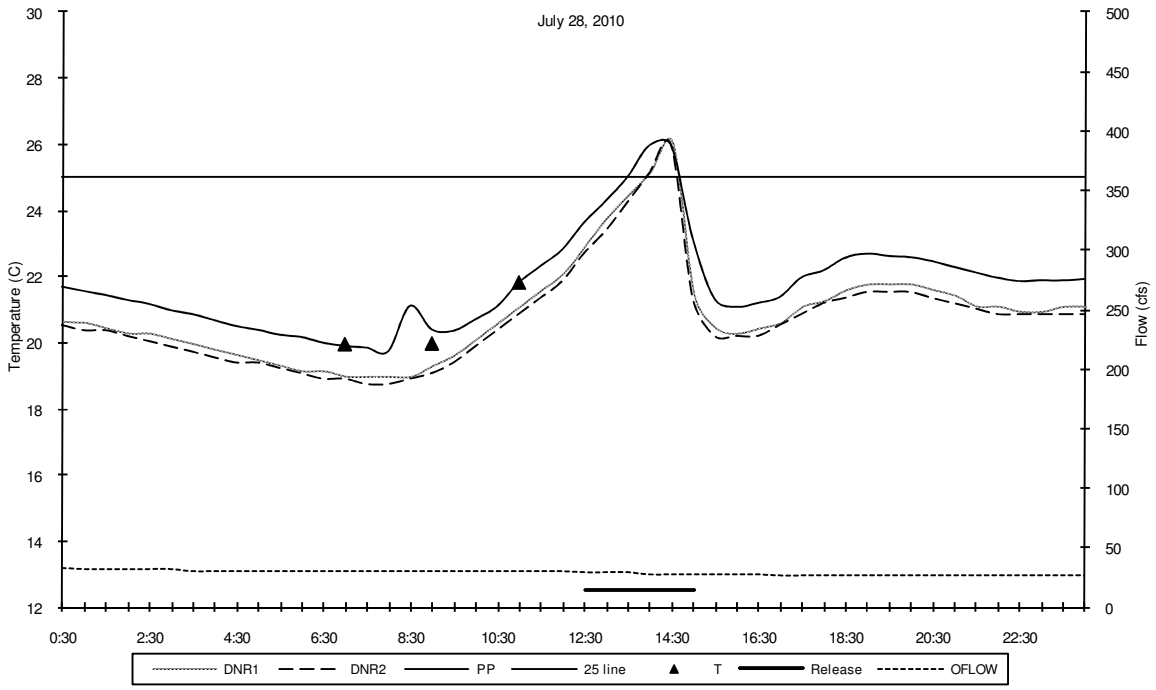
P7	P9	P11	P12	P14	P15	Temperature		PCLD	10
26.5						OFLOW	43.1	ECLD	7
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	25	SMAX	25.8
27.3	27.9	27.7	27.8	18.6	18.8	EMAX	31.7	SWAMAX	27.8
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	31.1	STIME25	13:00:00
26.5						TAIR	31.1	STIMEMAX	13:00:00



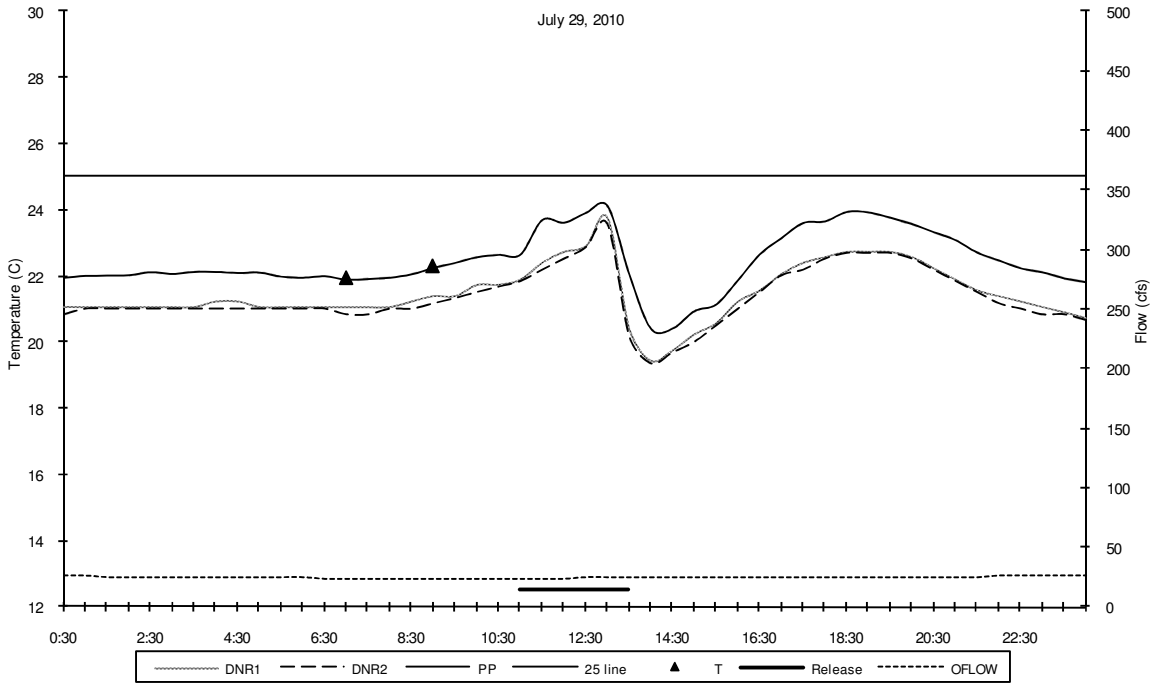
P7	P9	P11	P12	P14	P15	WhiteWater & Temperature		PCLD	6
23.9	23.8	27.2				OFLOW	83.4	ECLD	7.1
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	112	SMAX	25.8
23.5	23.9	28.1	28.1	21.3	21.6	EMAX	30.6	SWAMAX	26.7
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.9	STIME25	13:00:00
23.4	23.8	27.2				TAIR	28.3	STIMEMAX	13:00:00



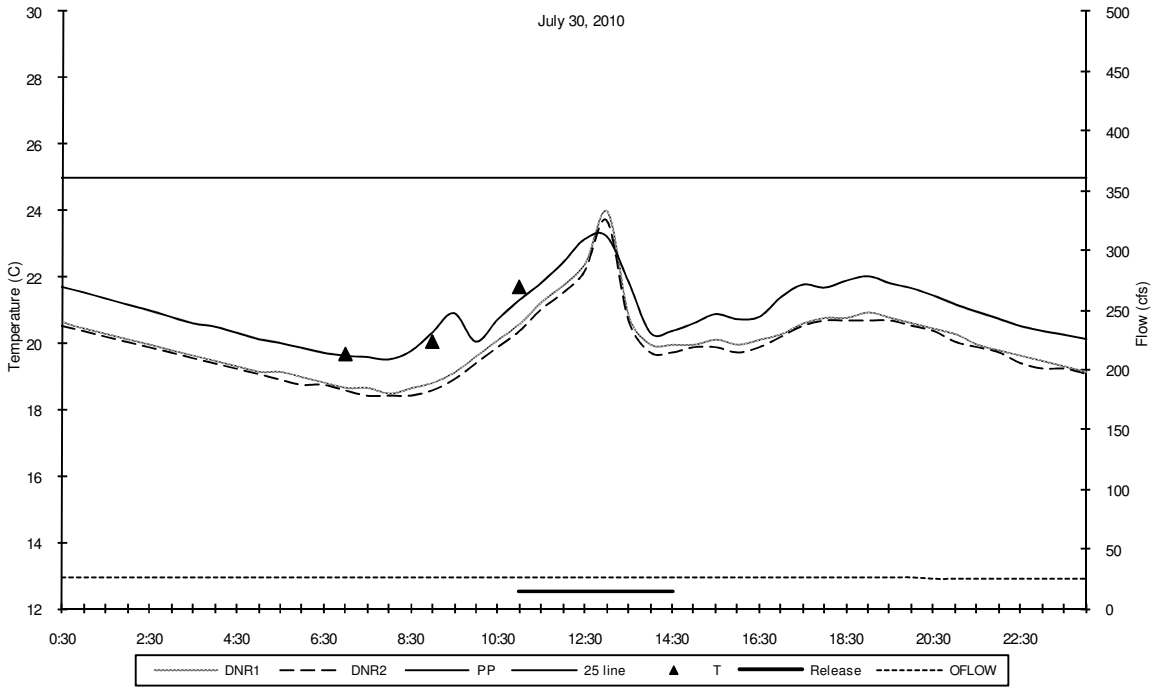
P7	P9	P11	P12	P14	P15	Temperature		PCLD	10
24.7	24.4	26.3				OFLOW	41.2	ECLD	6.4
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	48	SMAX	25
25.5	25.5	26.8	26.5	25.7	21.4	EMAX	29.4	SWAMAX	27.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.2	STIME25	
24.7	24.4	26.3				TAIR	29.4	STIMEMAX	



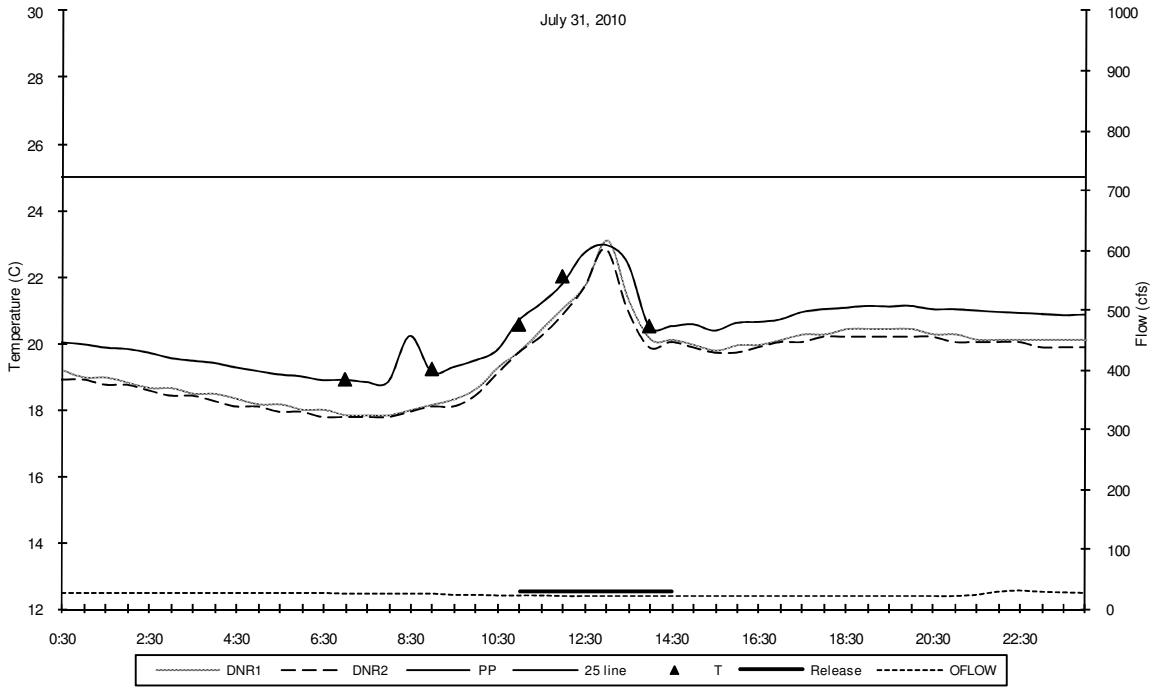
P7	P9	P11	P12	P14	P15	Temperature		PCLD	8
25.8	25.7	26.6				OFLOW	28.7	ECLD	8.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	30	SMAX	26
25.8	25.8	26.4	26.2	27.6	22.1	EMAX	30.6	SWAMAX	27.8
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.9	STIME25	14:00:00
25.8	25.7	26.6				TAIR	28.9	STIMEMAX	14:30:00



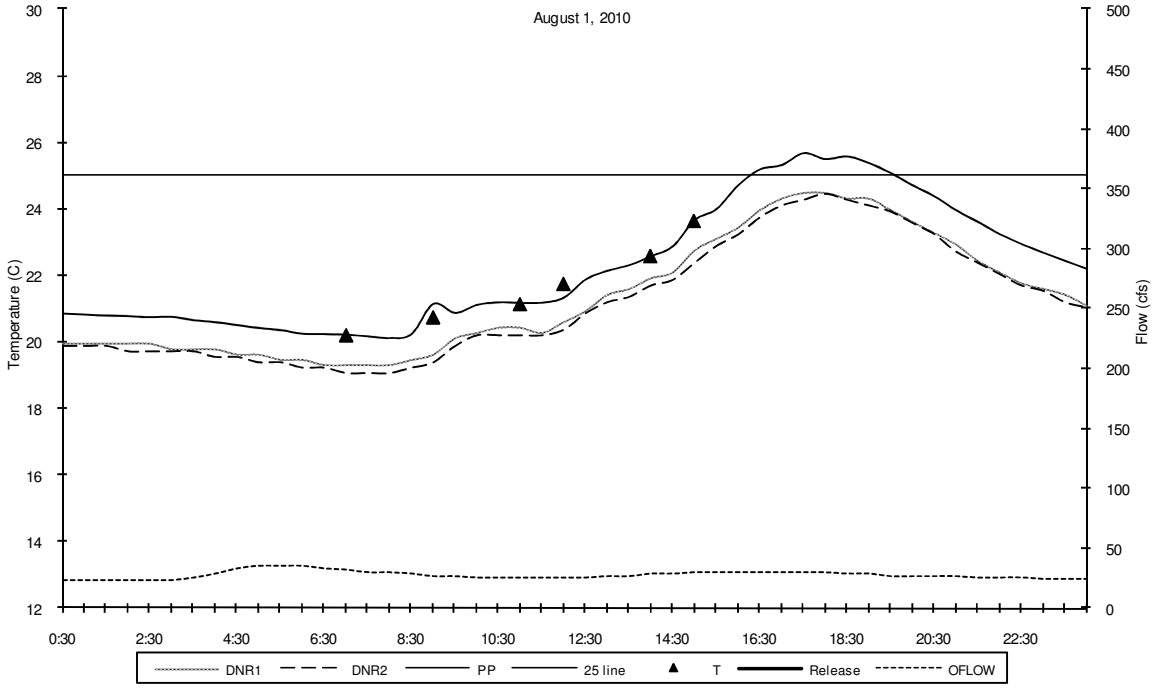
P7	P9	P11	P12	P14	P15	Temperature		PCLD	10
25.6	26					OFLOW	24.9	ECLD	9.1
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	25	SMAX	23.7
26.3	26.5	25.8	25.9	19.5	20.5	EMAX	30.6	SWAMAX	28.2
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	30	STIME25	
25.6	26					TAIR	28.3	STIMEMAX	



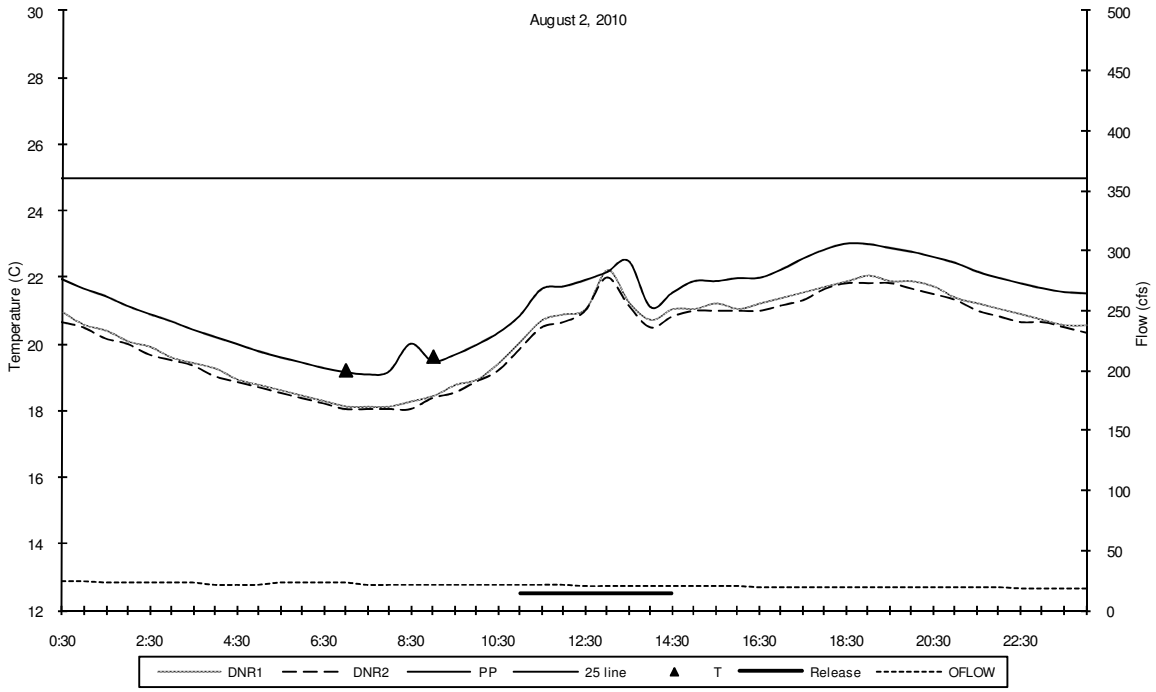
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
25.1	25.6	25.8				OFLOW	25.8	ECLD	8.2
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	26	SMAX	23.8
24.7	24.6	25.3	25.4	20.3	20.4	EMAX	27.2	SWAMAX	26.7
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.8	STIME25	
25.1	25.6	25.8				TAIR	25.6	STIMEMAX	



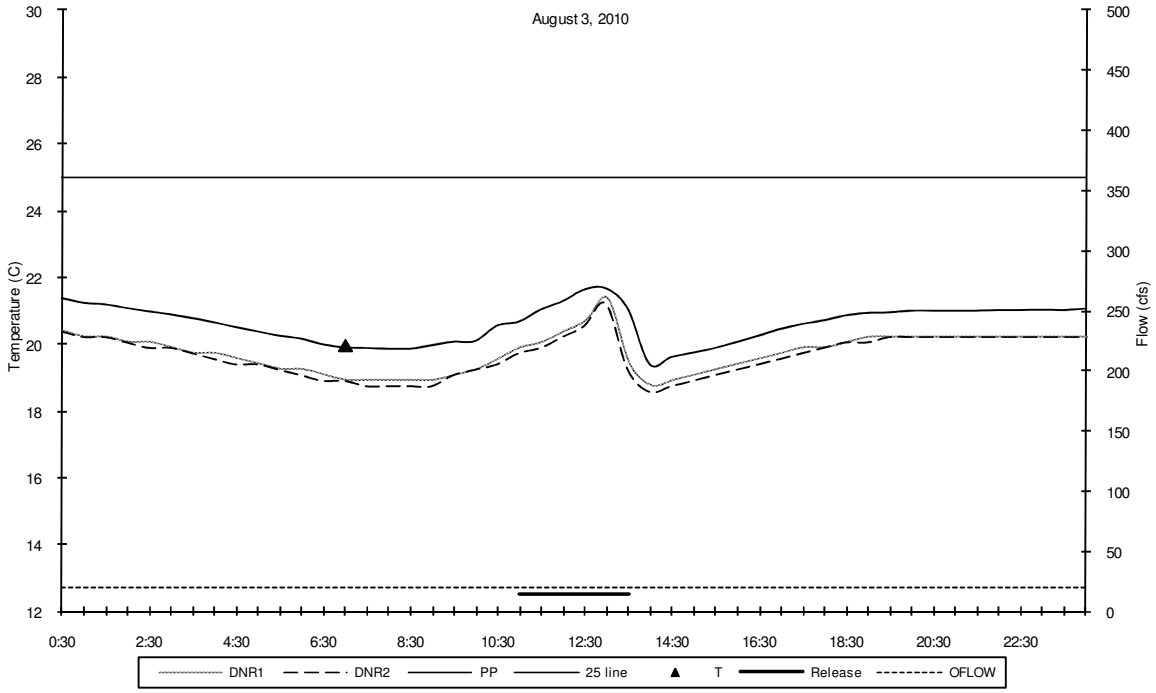
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	8
24.2	24.4	24.5	25.1	20.7	21.1	OFLOW	22.7	ECLD	8.3
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	25	SMAX	23
24.2	24.3	24.6	24.8	20.8	20.5	EMAX	26.7	SWAMAX	26.5
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	23.9	STIME25	
24.2	24.4	24.5	25.1	20.7	55.3	TAIR	25	STIMEMAX	



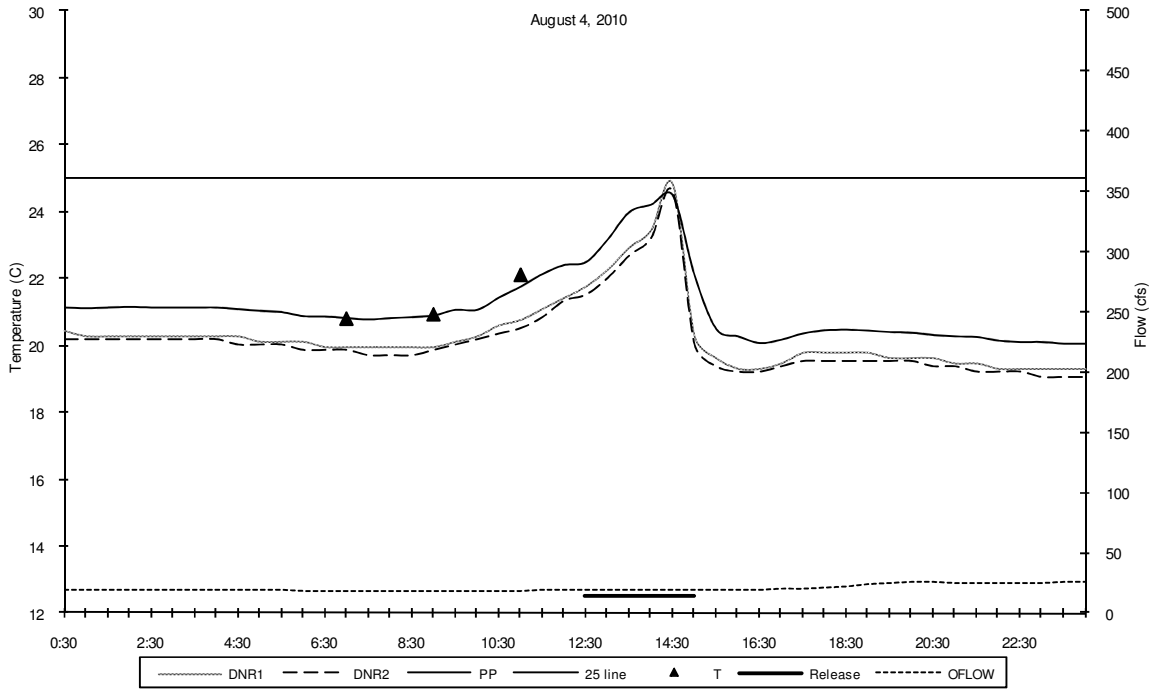
P7	P9	P11	P12	P14	P15			PCLD	10
24.2	24.8	23.9	24.1	23.8	24.5	OFLOW	28	ECLD	9.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	32	SMAX	24.5
24.2	24.4	24	23.5	23.6	23.7	EMAX	26.7	SWAMAX	25.3
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	25.6	STIME25	
24.2	24.8	23.9	24.1	23.8	24.5	TAIR	26.1	STIMEMAX	



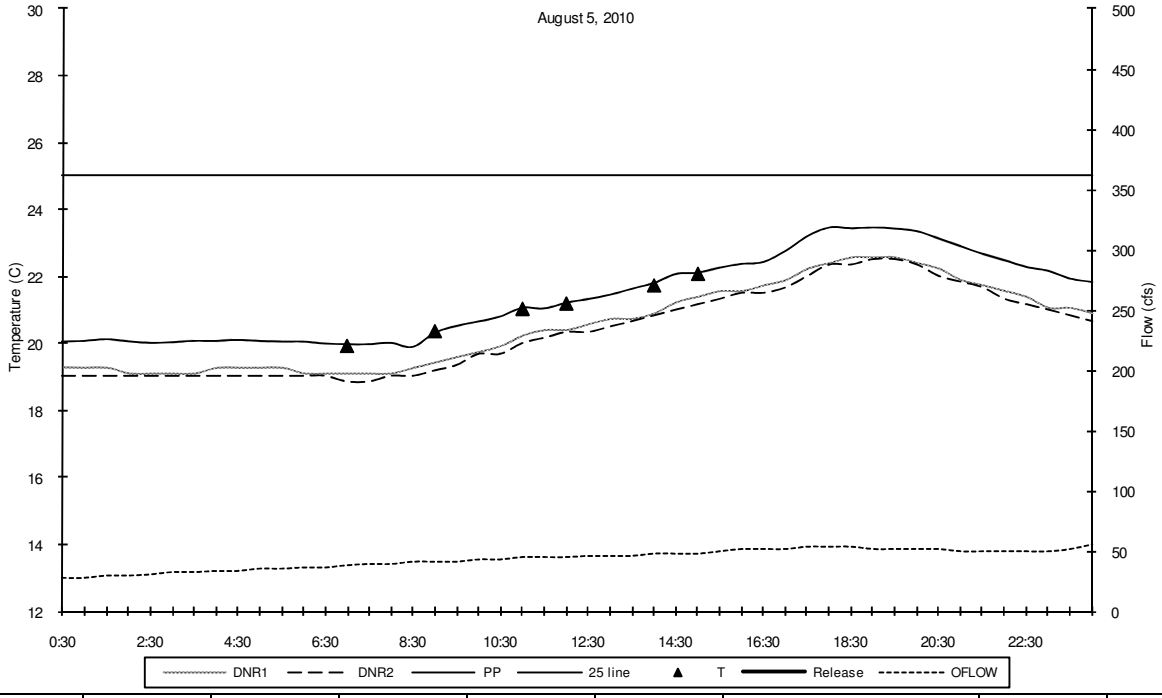
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
26.7	26.1					OFLOW	21.6	ECLD	2.8
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	22	SMAX	22.1
25.8	26.1	25.6	25.2	21.9	22	EMAX	27.8	SWAMAX	26.4
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX		STIME25	
25.7	26.1					TAIR	27.8	STIMEMAX	



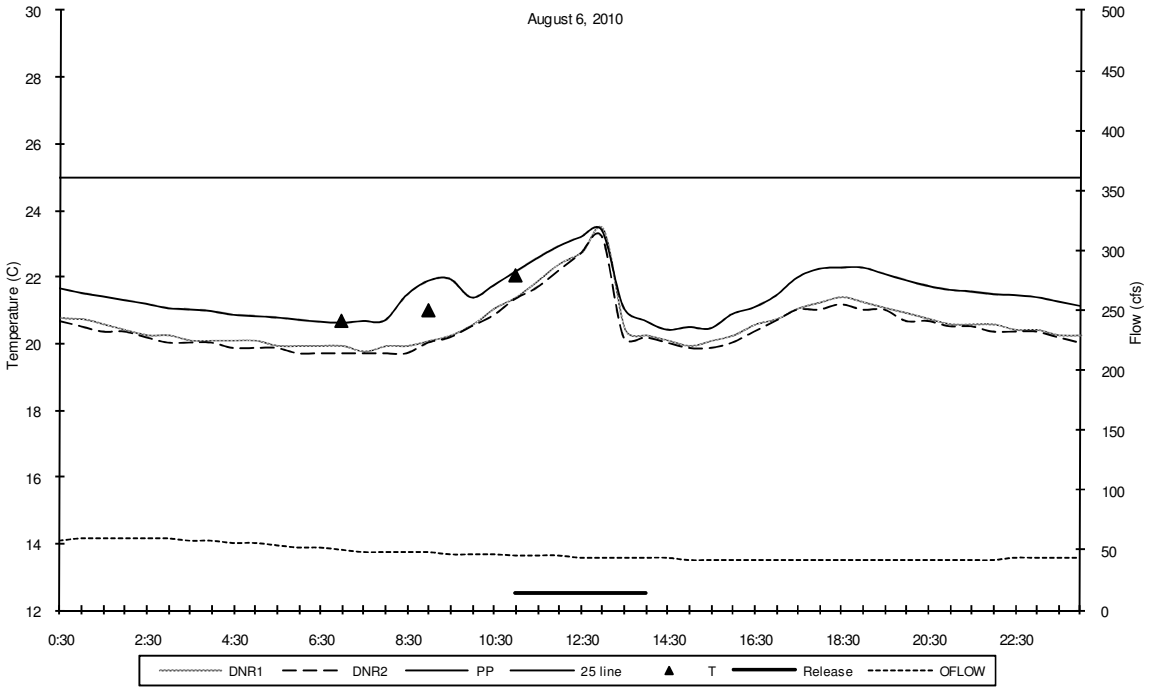
P7	P9	P11	P12	P14	P15	Temperature		PCLD	6
26.5						OFLOW	19	ECLD	5.3
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	19	SMAX	21.3
25.7	25.5	24.8	24.3	19.6	19.8	EMAX	27.8	SWAMAX	24.6
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	25	STIME25	
26.5						TAIR	29.4	STIMEMAX	



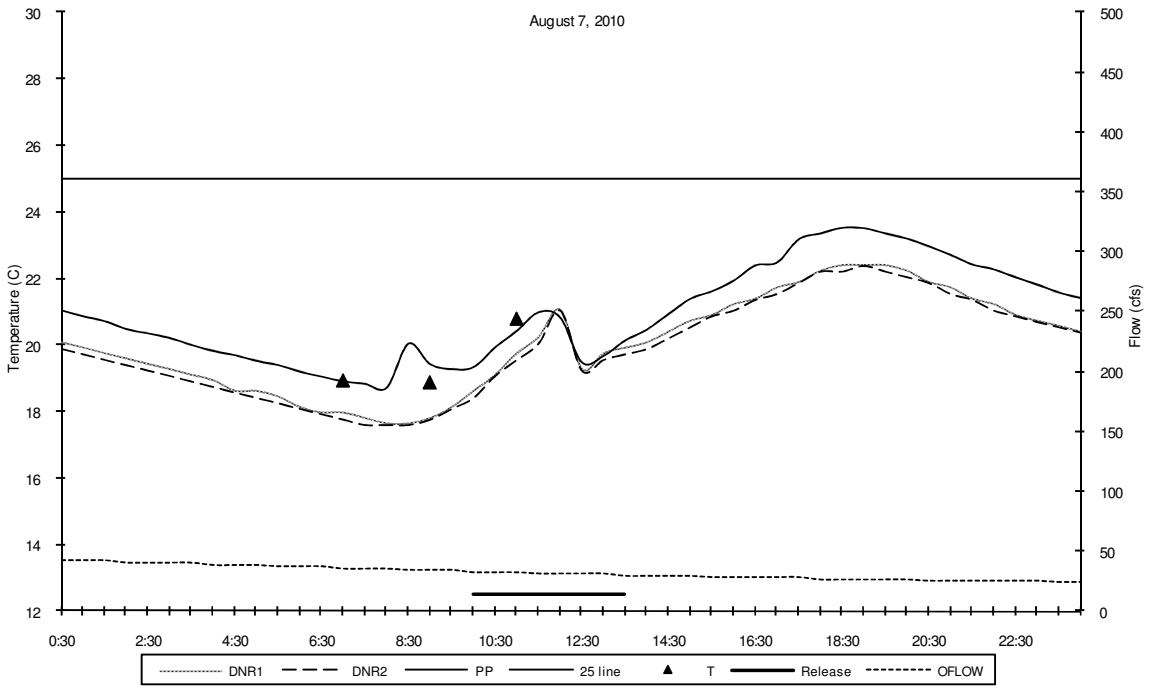
P7	P9	P11	P12	P14	P15	Temperature		PCLD	10
25.9	25.9	26.2				OFLOW	20.3	ECLD	8.3
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	19	SMAX	24.7
26.4	26.1	25.5	25.4	25.6	20.9	EMAX	31.1	SWAMAX	26.4
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	25.6	STIME25	
25.9	25.9	26.2				TAIR	30.6	STIMEMAX	



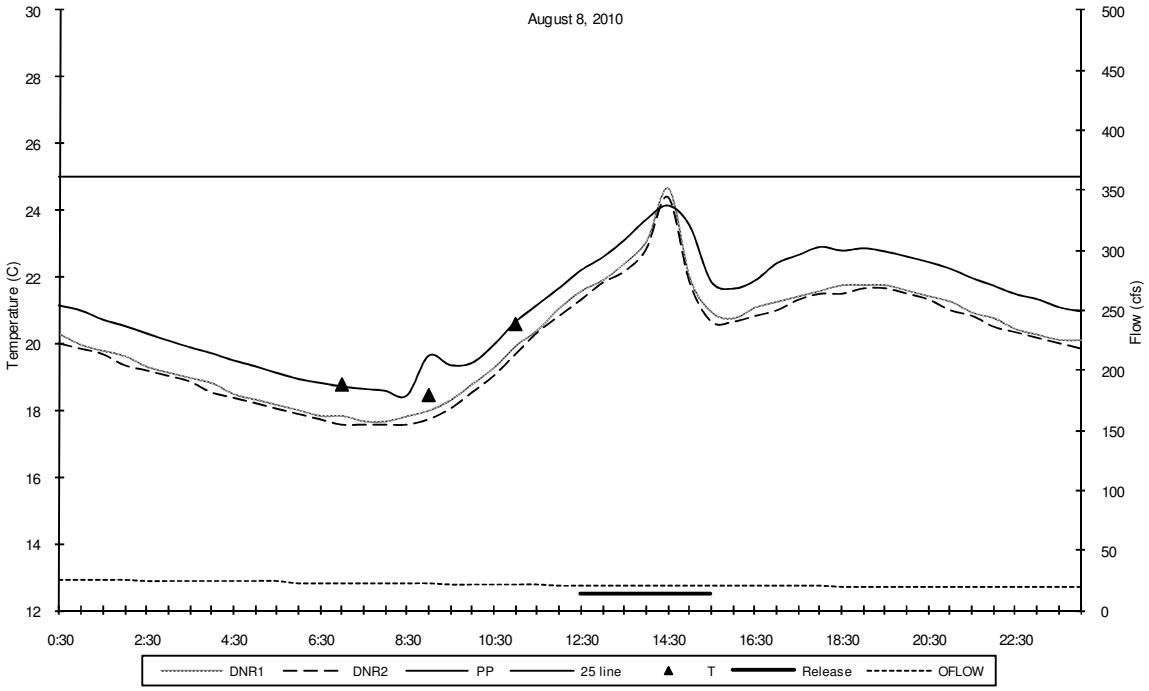
P7	P9	P11	P12	P14	P15			PCLD	10
25	25.3	24.8	24.3	23.3	23.1	OFLOW	43	ECLD	7.4
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	33	SMAX	22.6
26.2	26.3	25.4	24.7	22.9	22.5	EMAX	31.1	SWAMAX	24.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.3	STIME25	
24.9	25.3	24.8	24.3	23.3	23.1	TAIR	28.9	STIMEMAX	



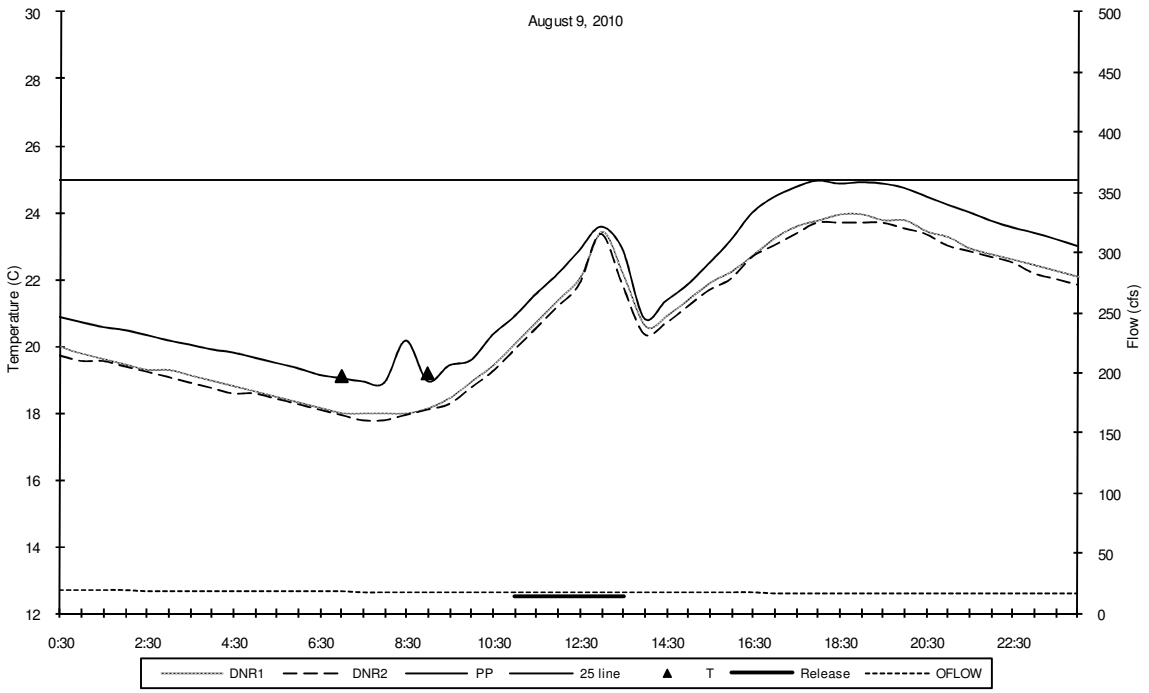
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
25	25.4					OFLOW	47.3	ECLD	7.8
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	56	SMAX	23.3
24	24.2	25.3	25.4	20.4	20.1	EMAX	26.7	SWAMAX	25.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	24.4	STIME25	
25	25.4	25.9				TAIR	27.2	STIMEMAX	



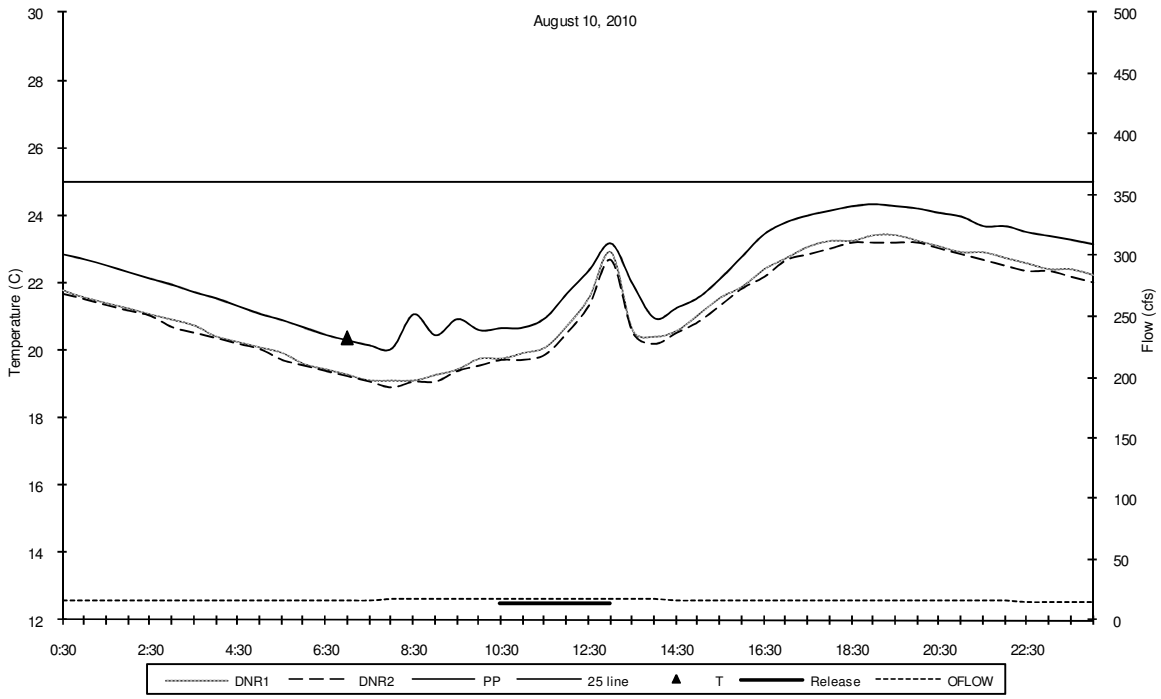
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
25.2	25	26				OFLOW	33	ECLD	8.6
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	39	SMAX	22.4
23.8	23.4	24.7	25	20.8	21.3	EMAX	26.7	SWAMAX	24.8
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	25	STIME25	
25.2	25	26				TAIR	27.8	STIMEMAX	



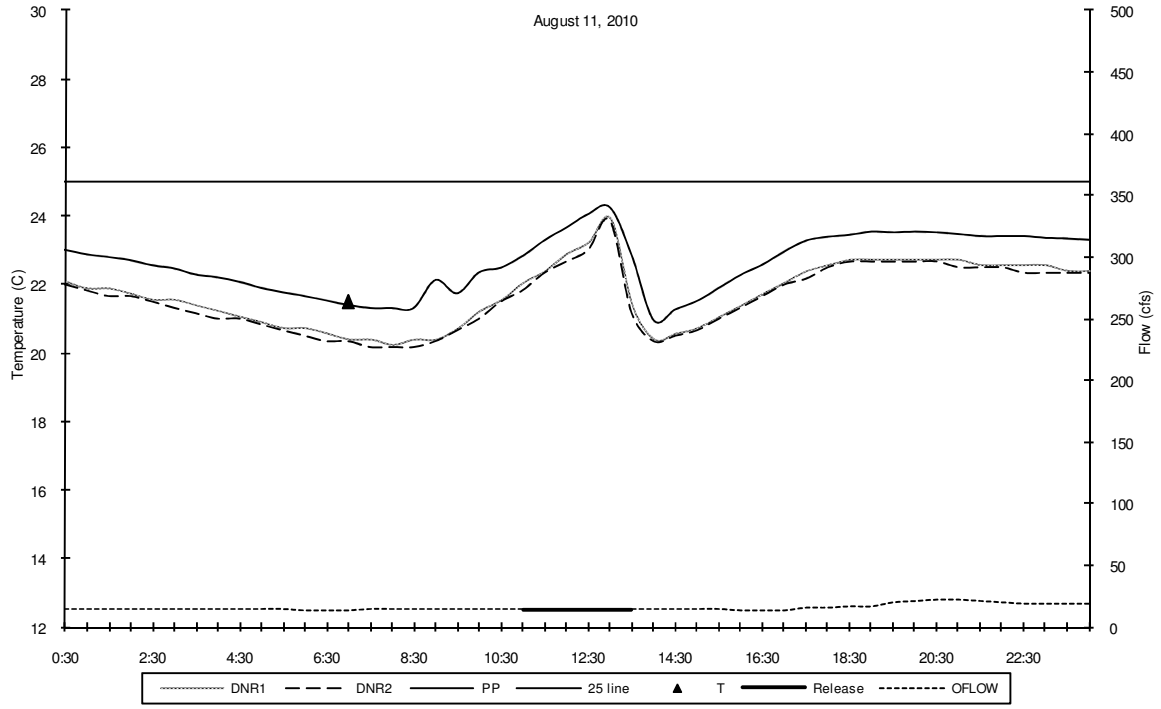
P7	P9	P11	P12	P14	P15	Temperature		PCLD	6
26.1	25.5	26.5				OFLOW	21.2	ECLD	6.4
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	24	SMAX	24.5
25.4	25.3	25.7	25.6	25.1	22.9	EMAX	28.9	SWAMAX	27.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	26.1	STIME25	
26.1	25.5	26.5				TAIR	29.4	STIMEMAX	



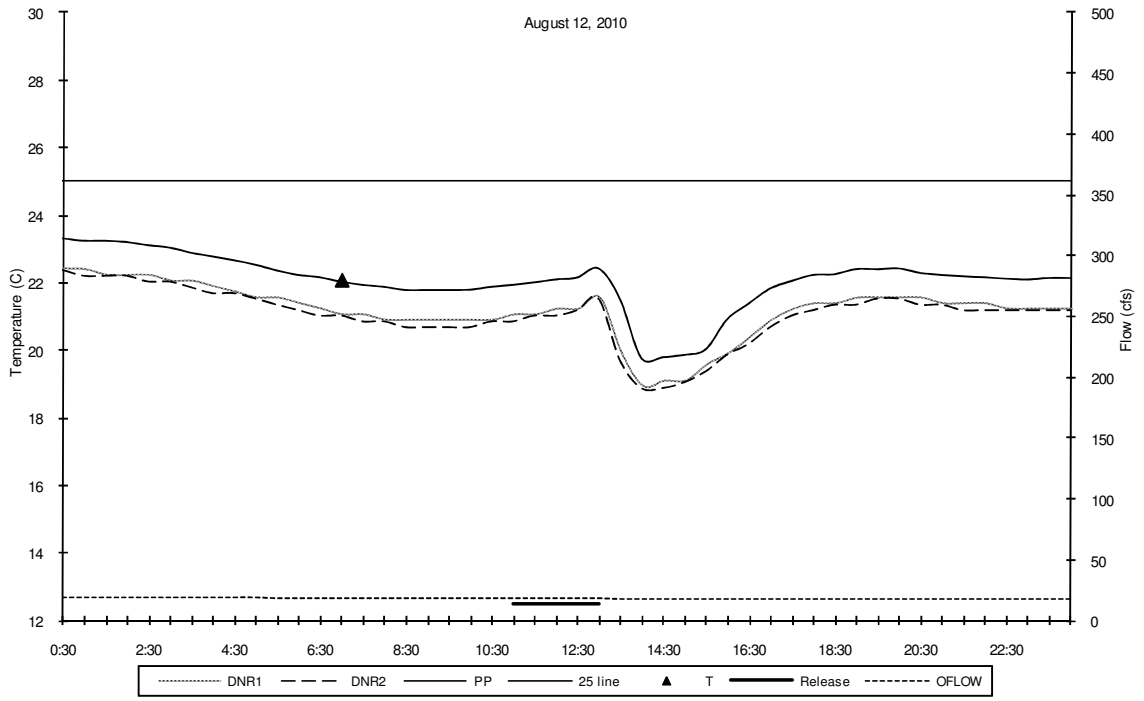
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
26.2	26.1					OFLOW	17.1	ECLD	8.3
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	18	SMAX	23.8
25.5	25.3	25.9	26	21.7	22.2	EMAX	30.6	SWAMAX	28.2
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.3	STIME25	
26.2	26.1					TAIR	29.4	STIMEMAX	



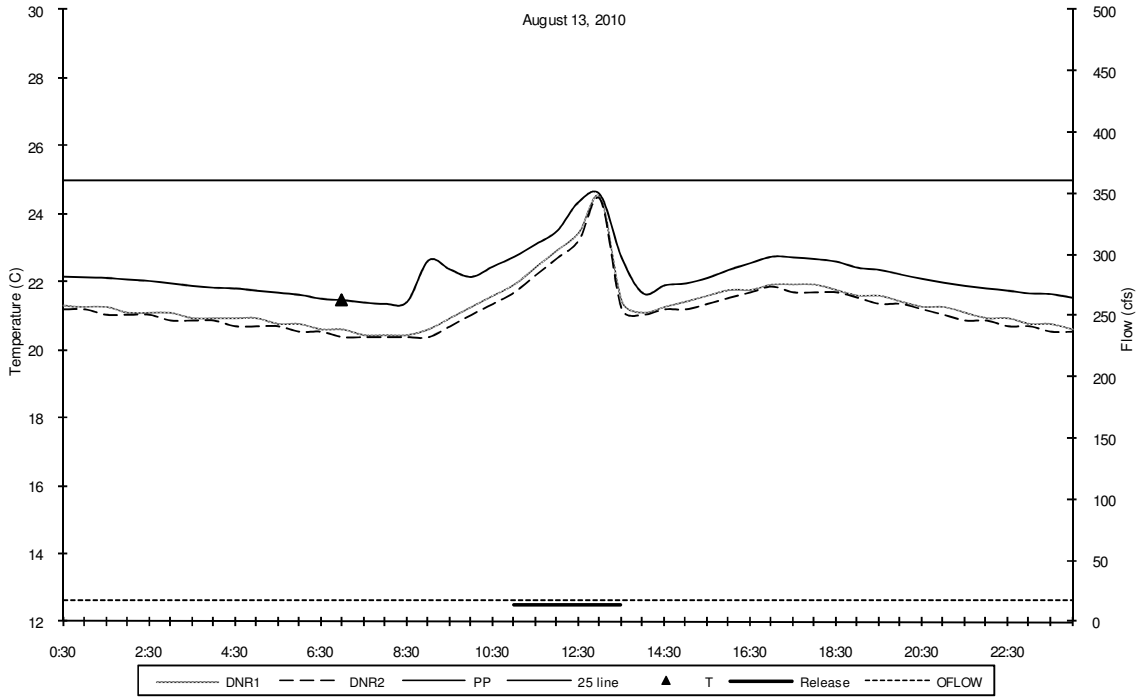
P7	P9	P11	P12	P14	P15	Temperature		PCLD	6
26.8						OFLOW	16.2	ECLD	5.8
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	16	SMAX	23.3
26.8	26.5	25.3	25.2	21.9	22.1	EMAX	31.1	SWAMAX	28.3
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	30.6	STIME25	
26.8						TAIR	30	STIMEMAX	



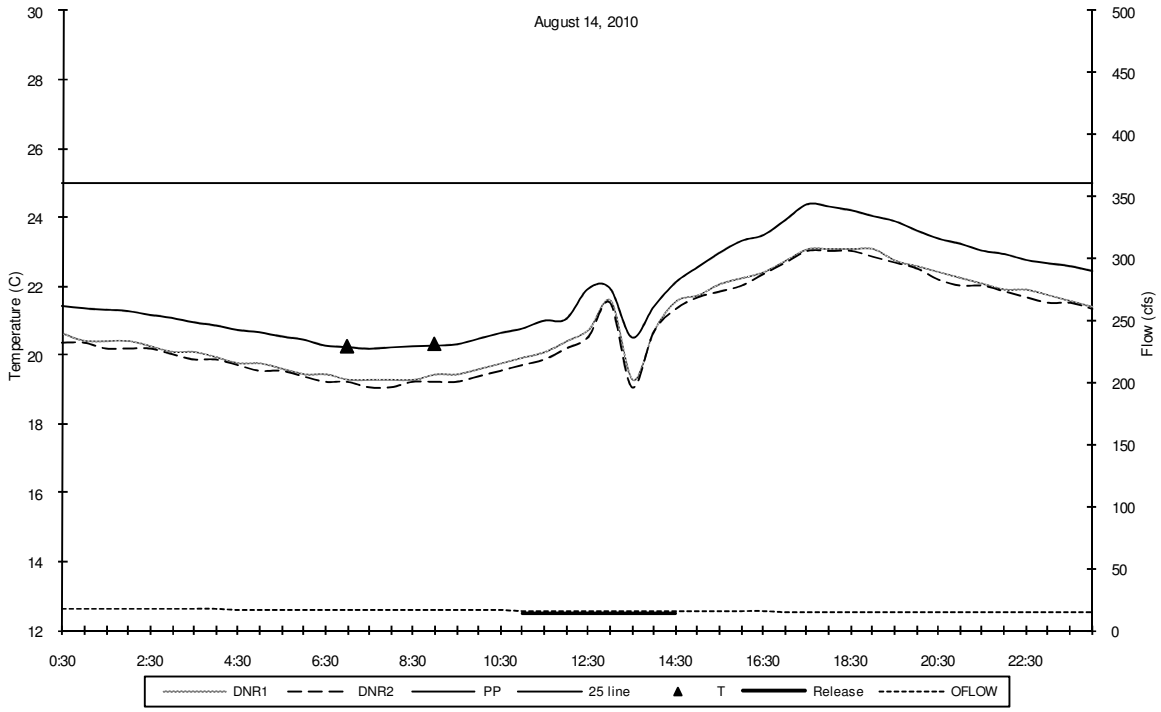
P7	P9	P11	P12	P14	P15	Temperature		PCLD	8
27						OFLOW	16	ECLD	4.9
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	15	SMAX	23.9
27.4	27.3	27.4	27	20.7	21.1	EMAX	31.1	SWAMAX	28.5
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	30.6	STIME25	
27						TAIR	31.1	STIMEMAX	



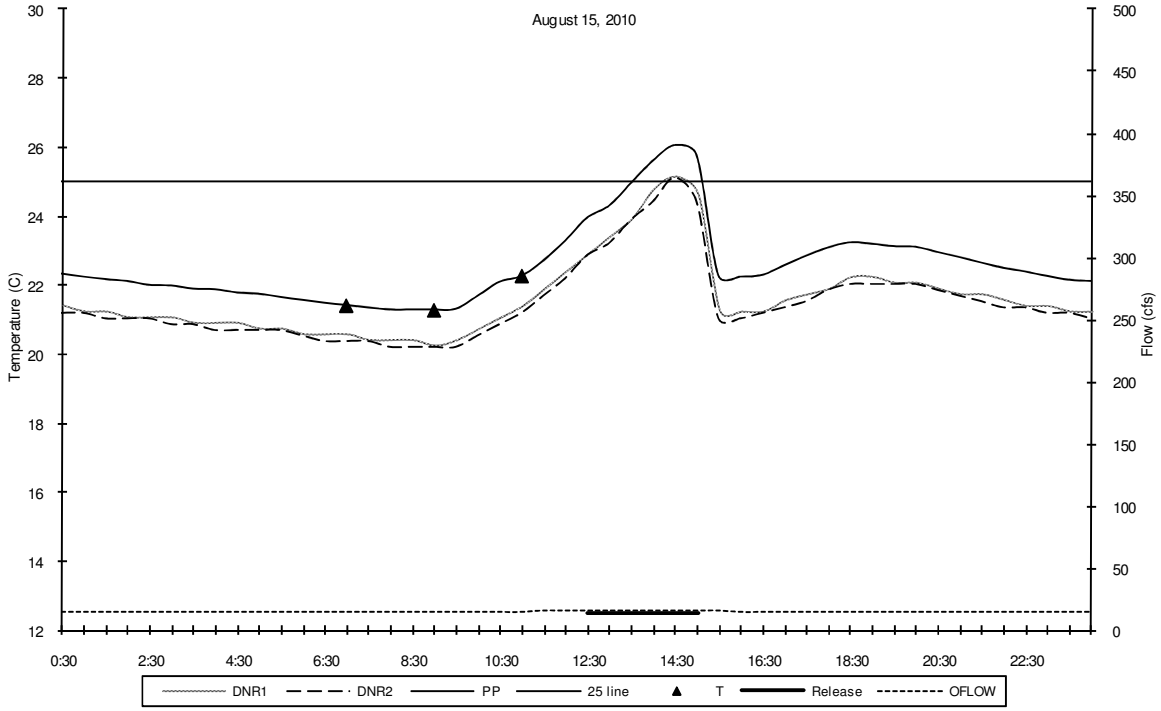
P7	P9	P11	P12	P14	P15	Temperature		PCLD	8
26.6						OFLOW	17.8	ECLD	9.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	19	SMAX	22.4
26.2	25.7	24.8	24.4	19.7	19.7	EMAX	30.6	SWAMAX	27.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	31.1	STIME25	
26.8						TAIR	30	STIMEMAX	



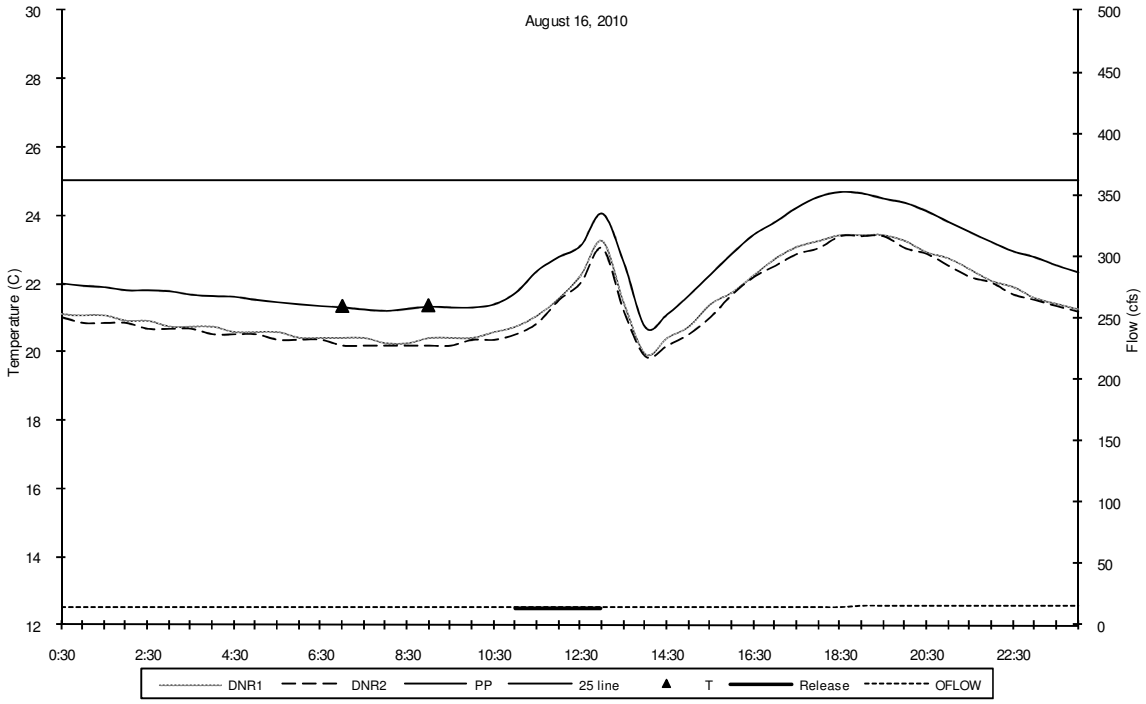
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	8
26.6						OFLOW	17.7	ECLD	8.3
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	17	SMAX	24.5
26.5	26.4	26.6	26.6	21.6	21.8	EMAX	31.1	SWAMAX	26.2
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.2	STIME25	
26.6						TAIR	30	STIMEMAX	



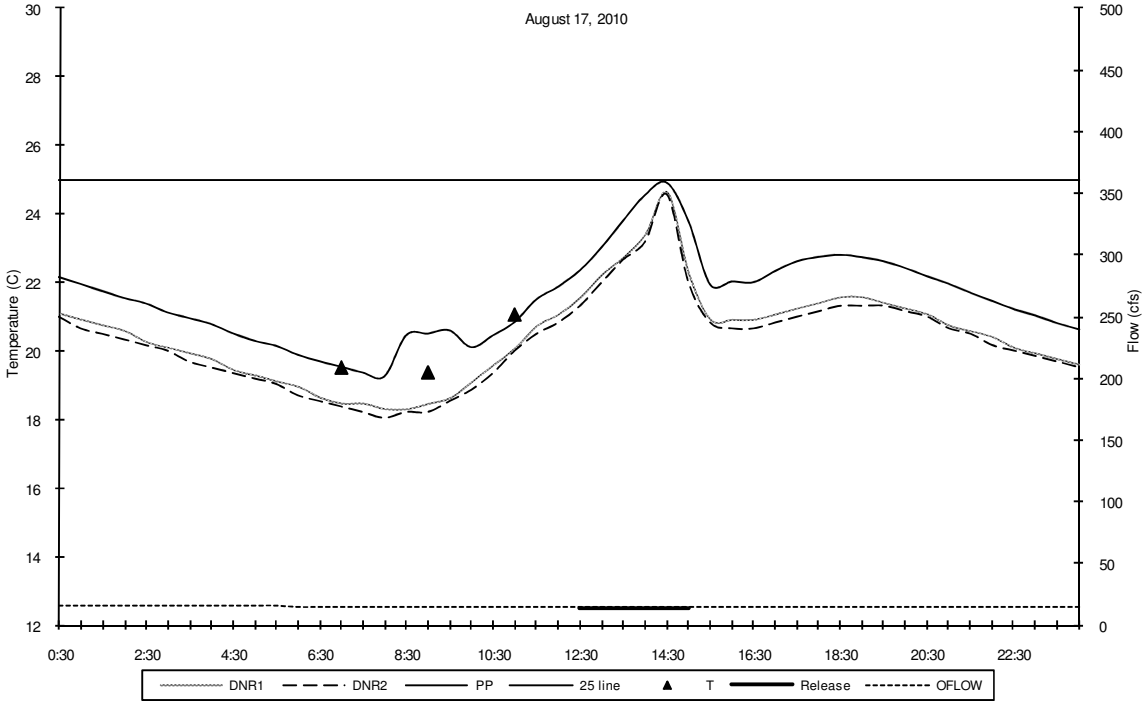
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	8
26	26					OFLOW	16.3	ECLD	5.6
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	18	SMAX	23.1
26.9	26.7	25.2	24.8	22.7	23	EMAX	31.1	SWAMAX	26.7
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	23.9	STIME25	
26	26					TAIR	29.4	STIMEMAX	



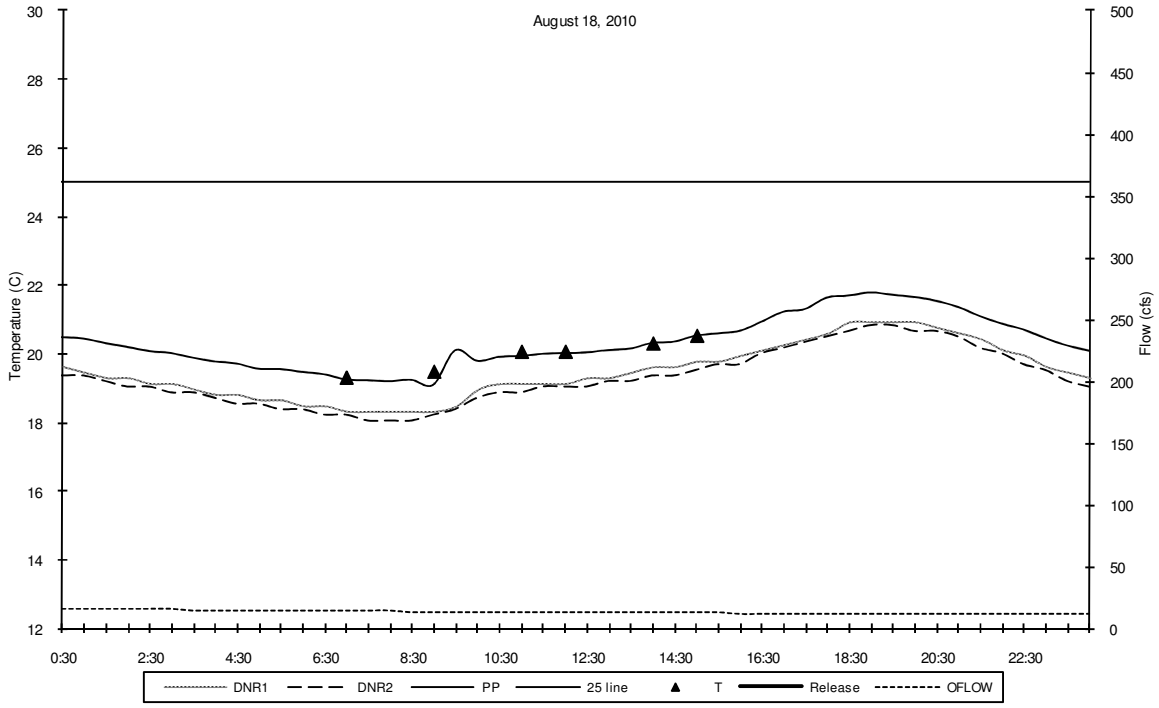
P7	P9	P11	P12	P14	P15	Temperature		PCLD	10
25.6	25.3	25.7				OFLOW	15.2	ECLD	9.2
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	16	SMAX	25.2
25.9	25.4	25.7	25.9	26.7	25.6	EMAX	30	SWAMAX	27.3
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	23.9	STIME25	
25.6	25.4	25.8				TAIR	29	STIMEMAX	



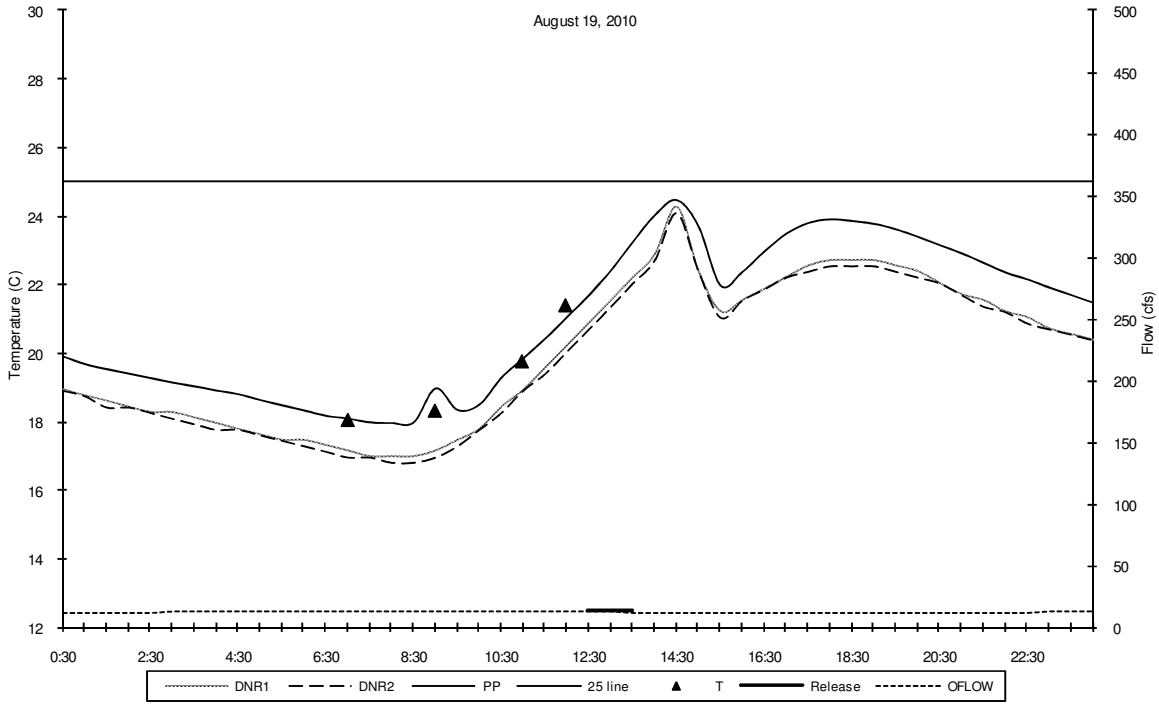
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
26.4	26.3					OFLOW	15.2	ECLD	5.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	15	SMAX	23.4
26.9	26.8	25.3	25.5	20.7	21.4	EMAX	30	SWAMAX	27.8
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.9	STIME25	14:30:00
26.4	26.5					TAIR	27.8	STIMEMAX	14:30:00



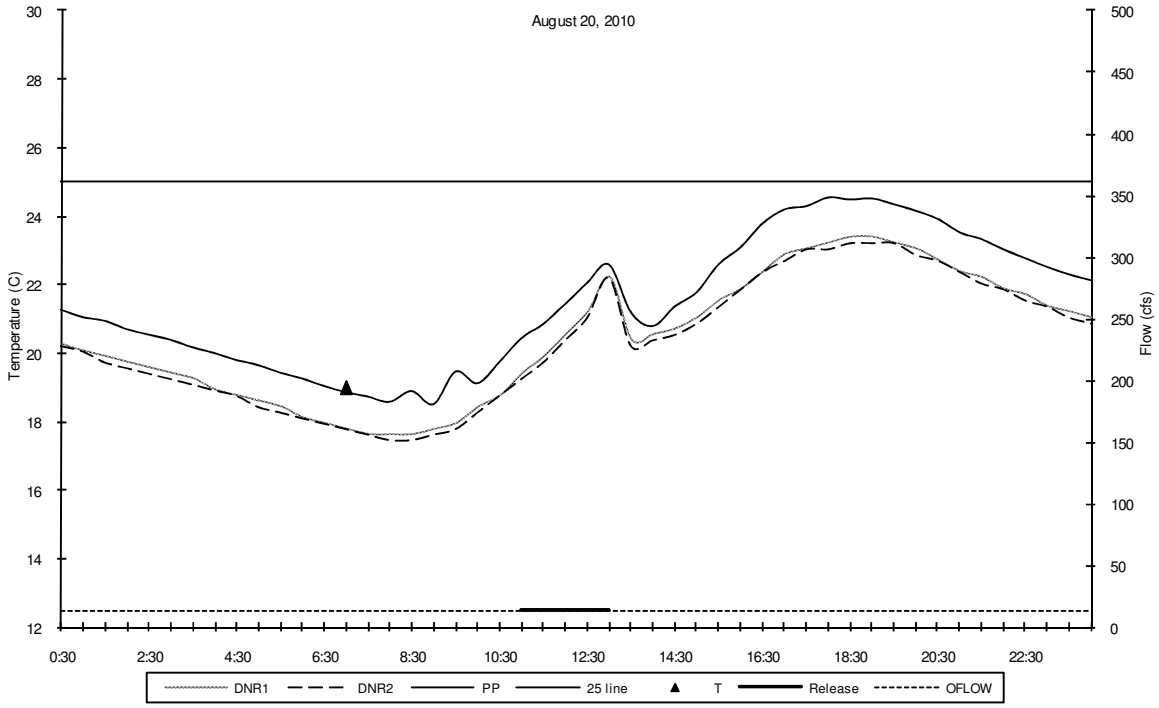
P7	P9	P11	P12	P14	P15	Temperature		PCLD	8
25.6	25.3	26				OFLOW	15.3	ECLD	8.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	16	SMAX	24.6
25.4	25	25.6	25.4	25.7	23.2	EMAX	30	SWAMAX	28
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.9	STIME25	
25.6	25.3	26				TAIR	28.9	STIMEMAX	



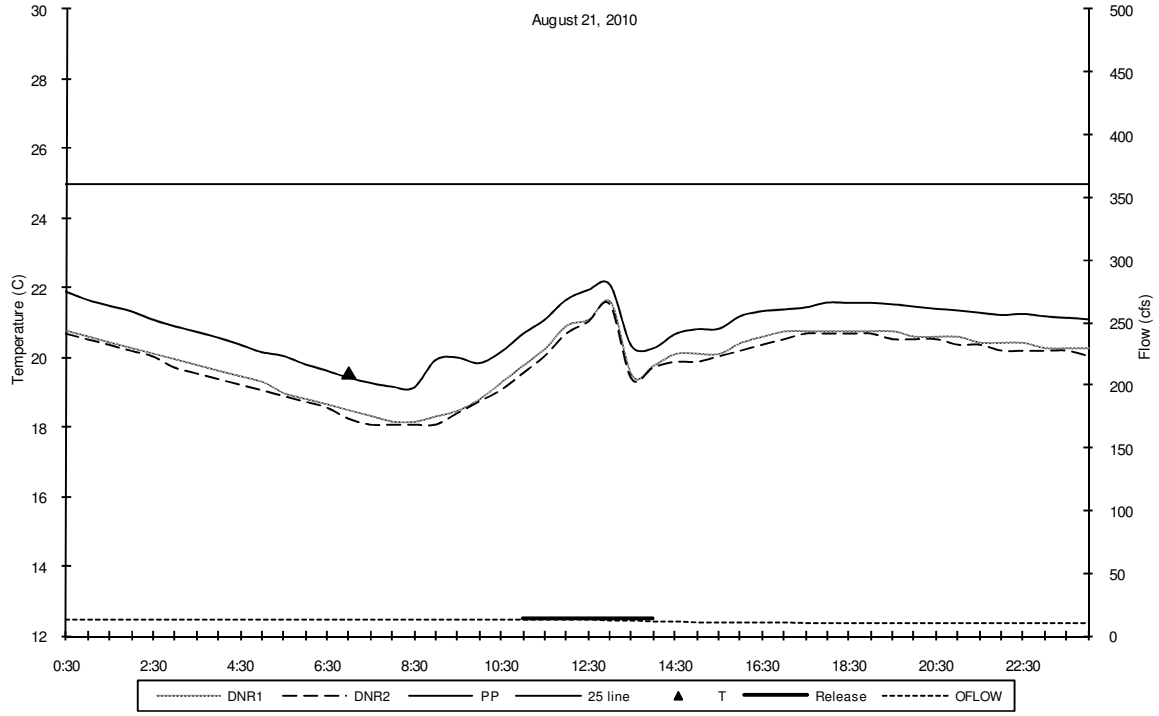
P7	P9	P11	P12	P14	P15			PCLD	8
24.1	24.3	23.4	22.8	21.6	21.4	OFLOW	13.2	ECLD	9.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	14	SMAX	20.9
24.7	24.4	23.8	23.1	21.5	20.9	EMAX	28.9	SWAMAX	23.8
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.3	STIME25	
24.1	24.3	23.4	22.8	21.6	21.4	TAIR	24.4	STIMEMAX	



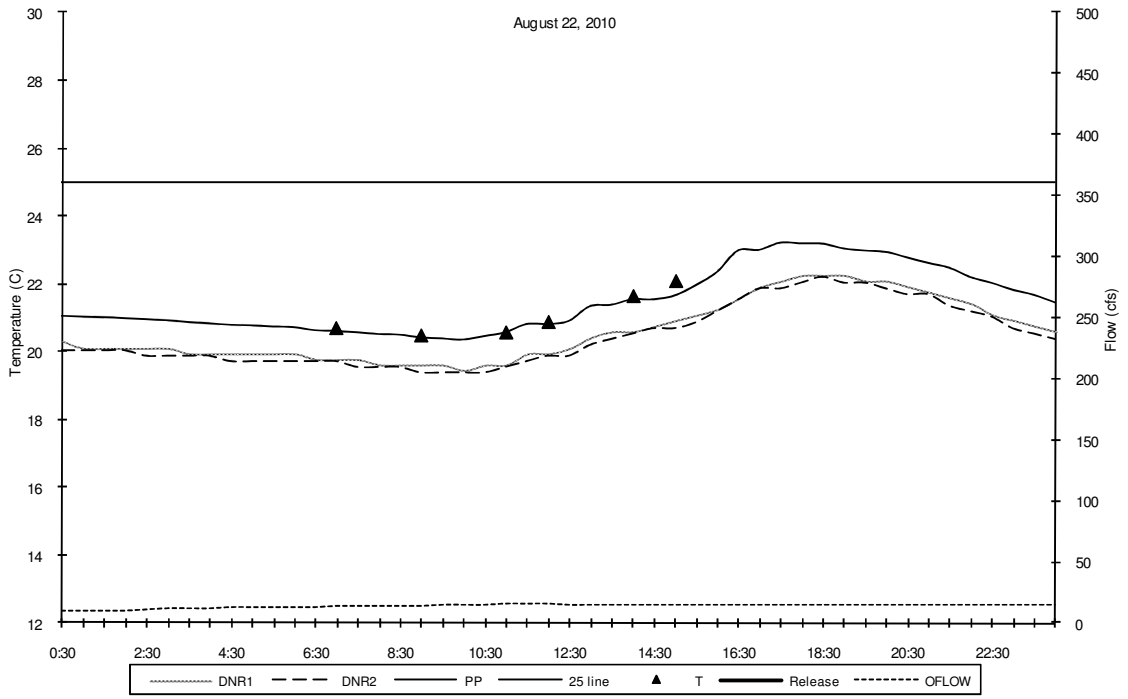
P7	P9	P11	P12	P14	P15	Temperature		PCLD	6
25.7	25.7	25.3	25.9			OFLOW	12.5	ECLD	9.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	13	SMAX	24.2
24.3	23.8	24.7	24.7	25.4	23.7	EMAX	28.9	SWAMAX	27.3
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.3	STIME25	
25.7	25.7	25.3	25.9			TAIR	28.9	STIMEMAX	



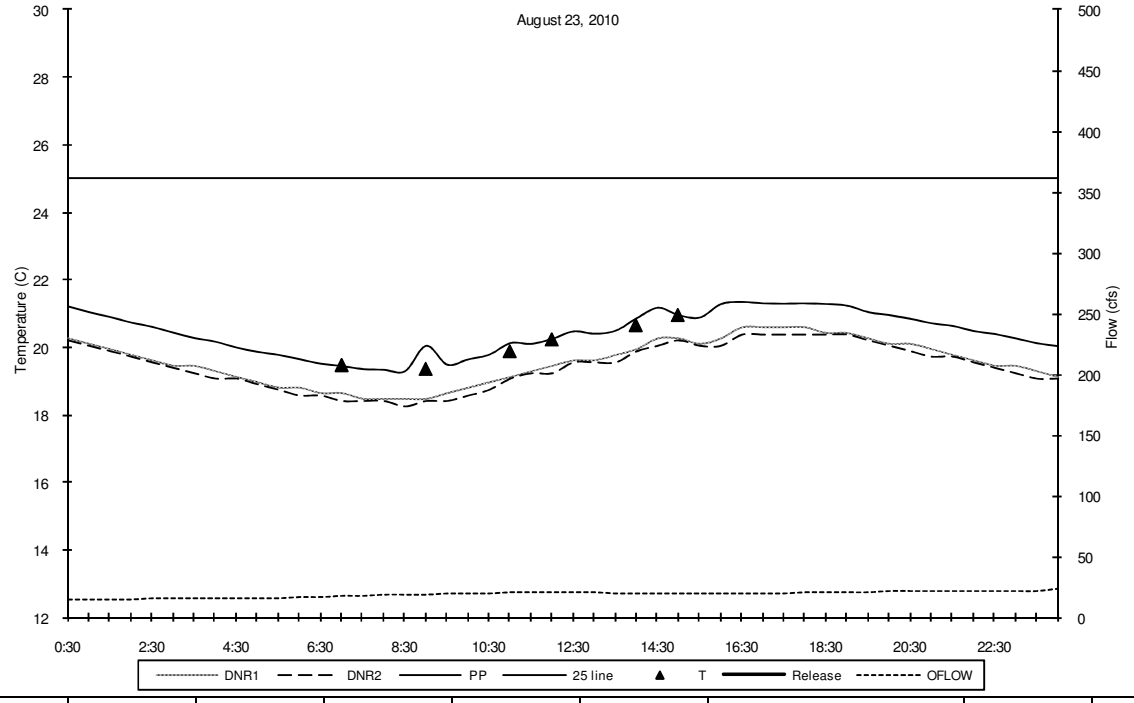
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
26.5						OFLOW	13	ECLD	7.1
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	13	SMAX	23.3
25.8	25.4	25.5	25.4	22.2	22.1	EMAX	30.6	SWAMAX	27.4
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	28.9	STIME25	
26.5						TAIR	30.6	STIMEMAX	



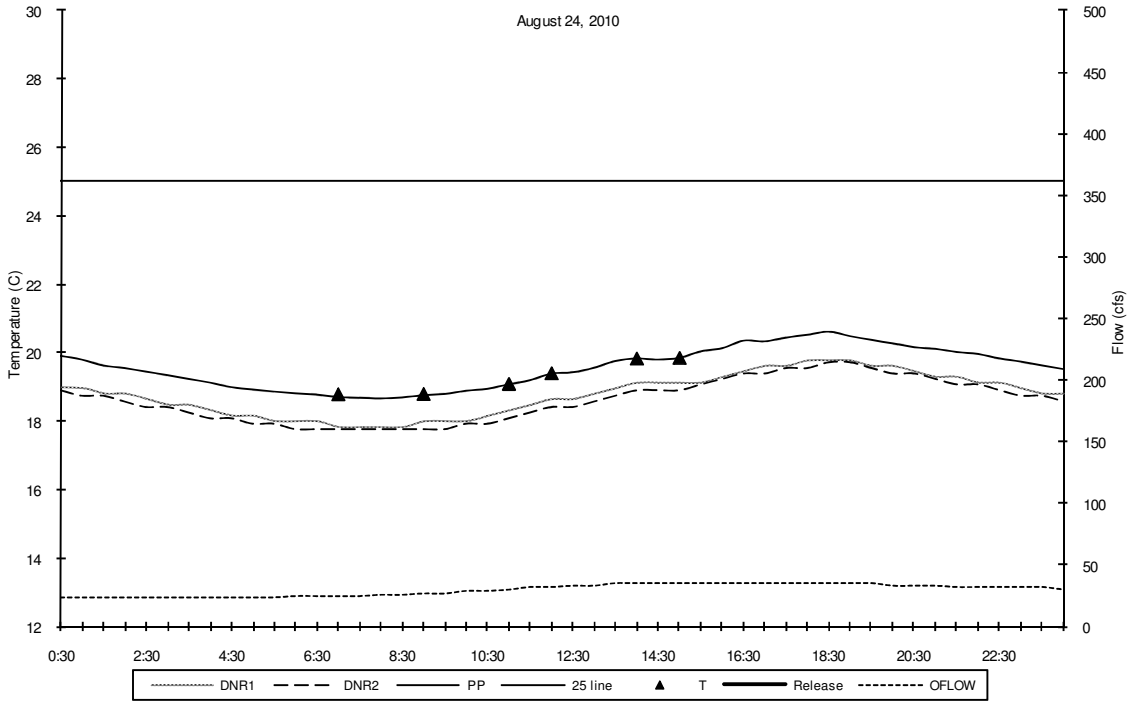
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
26.9						OFLOW	11.6	ECLD	5.4
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	13	SMAX	21.6
26.4	26	25.8	25.7	21	20.9	EMAX	30.6	SWAMAX	26.5
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	30.6	STIME25	
26.9						TAIR	31.1	STIMEMAX	



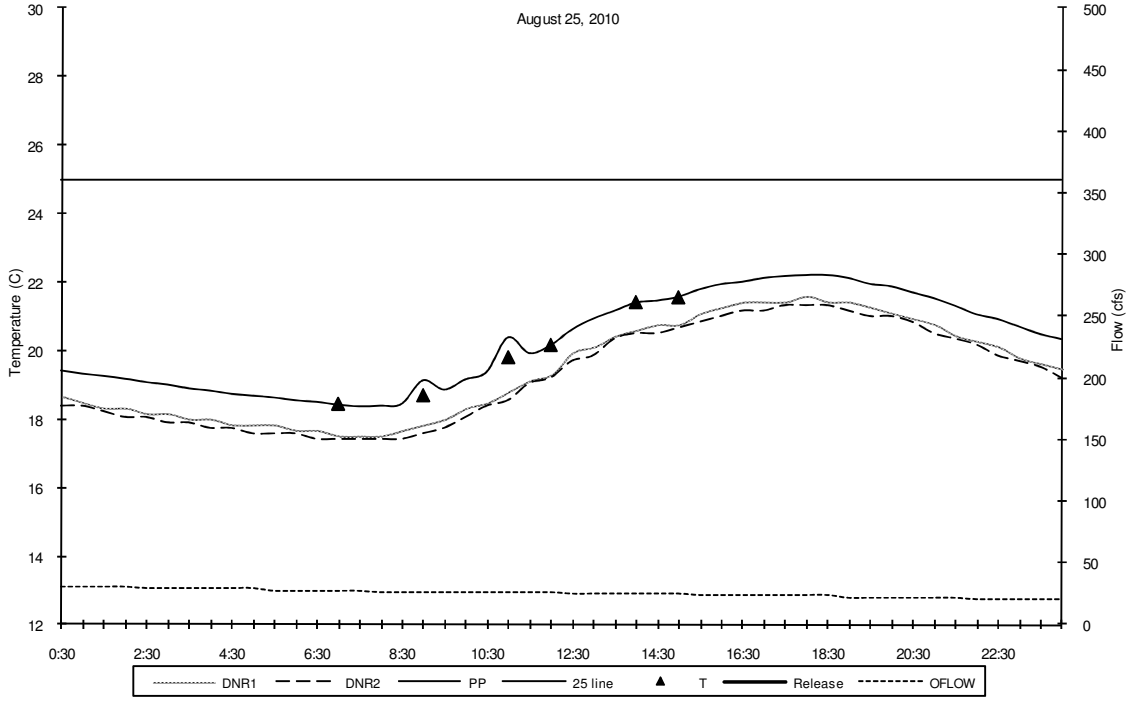
P7	P9	P11	P12	P14	P15			PCLD	8
25.1	24.9	23.7	23.6	23.1	23	OFLOW	14	ECLD	9.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	13	SMAX	22.2
25	24.5	23.4	23.2	22.4	22	EMAX	28.3	SWAMAX	24.8
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	30	STIME25	
25.1	24.9	23.7	23.5	23.1	23	TAIR	26.1	STIMEMAX	



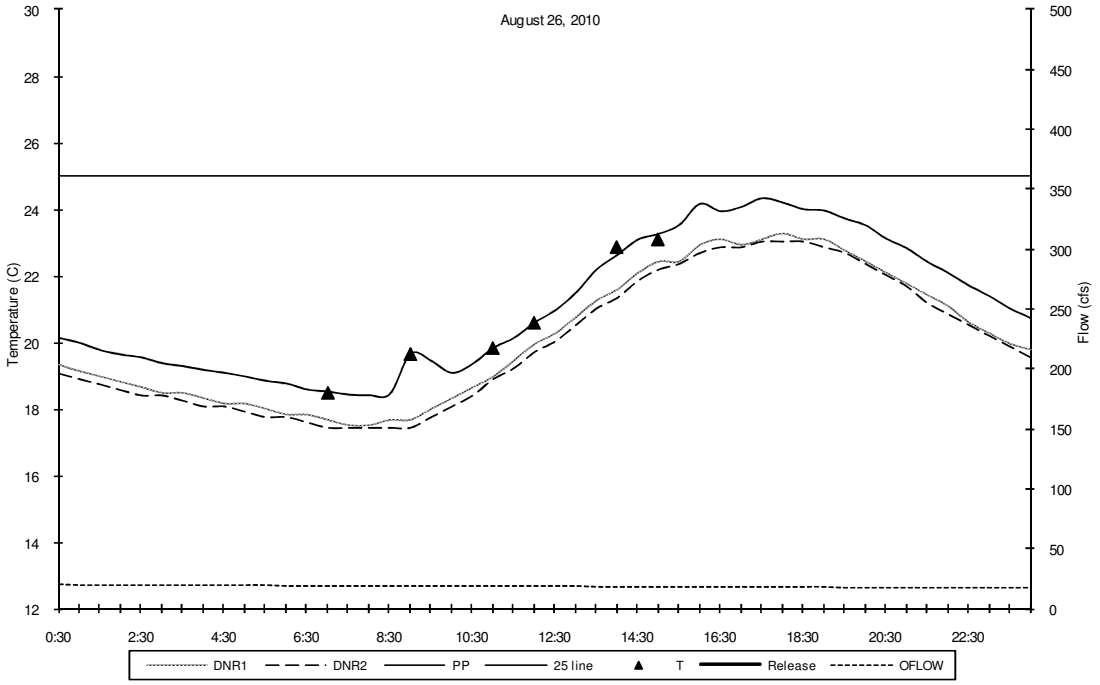
P7	P9	P11	P12	P14	P15			PCLD	8
23.8	23.7	23	22.8	21.8	21.8	OFLOW	19.2	ECLD	6.6
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	16	SMAX	20.5
25	24.7	23.7	23.1	21.7	21.4	EMAX	26.7	SWAMAX	23.6
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	25	STIME25	
23.8	23.7	23	22.8	21.8	21.8	TAIR	23.3	STIMEMAX	



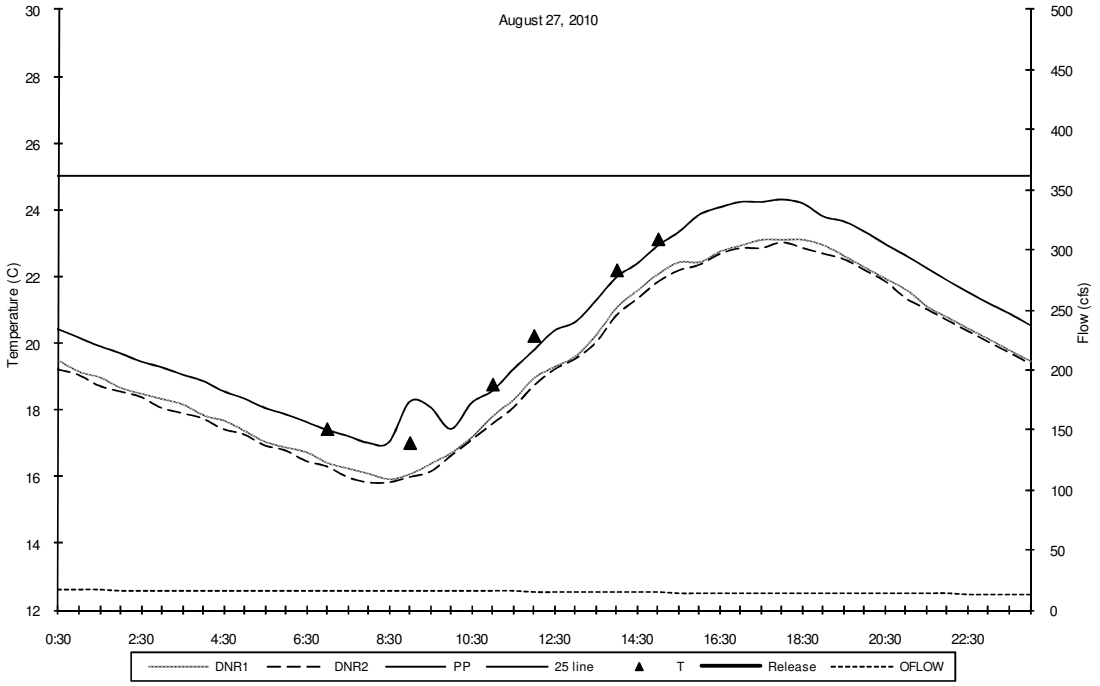
P7	P9	P11	P12	P14	P15			PCLD	8
23.6	23.6	22.4	22.2	21.2	20.8	OFLOW	29.7	ECLD	8
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	24	SMAX	19.8
23.2	23.2	21.9	21.6	20.6	20.1	EMAX	23.3	SWAMAX	21.6
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX		STIME25	
23.6	23.5	22.4	22.2	21.2	20.8	TAIR	23.3	STIMEMAX	



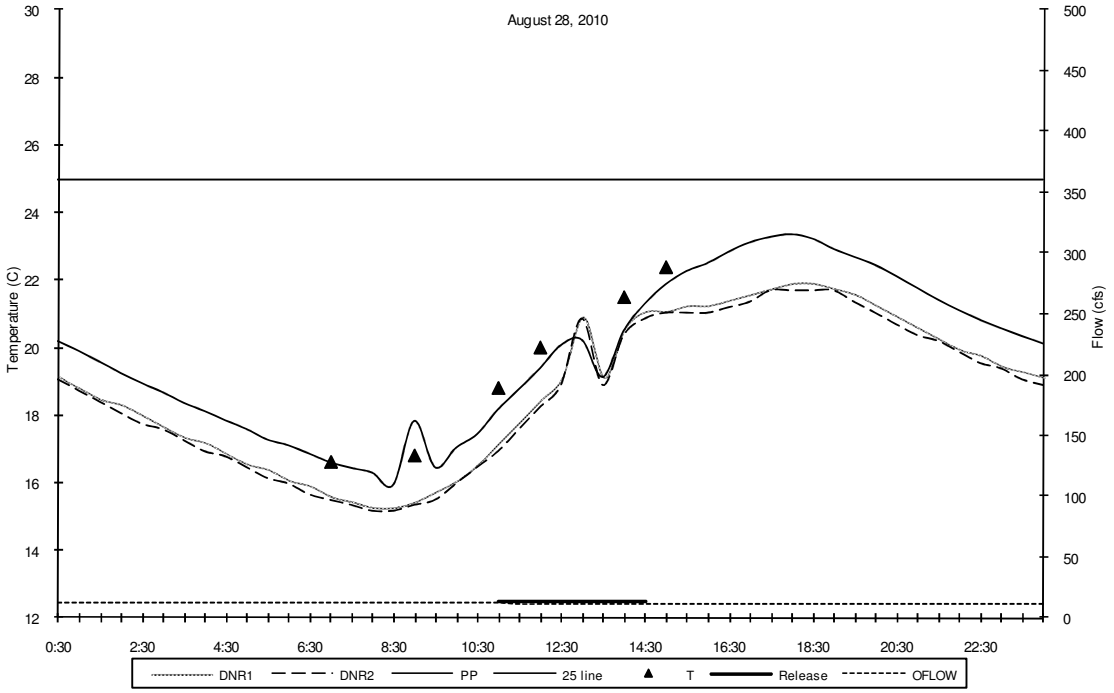
P7	P9	P11	P12	P14	P15			PCLD	8
23.8	24	23.7	23.3	23	22.5	OFLOW	25.6	ECLD	9.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	29	SMAX	21.5
22.8	22.9	22.6	22.4	22.4	21.9	EMAX	23.9	SWAMAX	22.1
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX		STIME25	
23.8	24	23.7	23.2	23	22.5	TAIR	24.4	STIMEMAX	



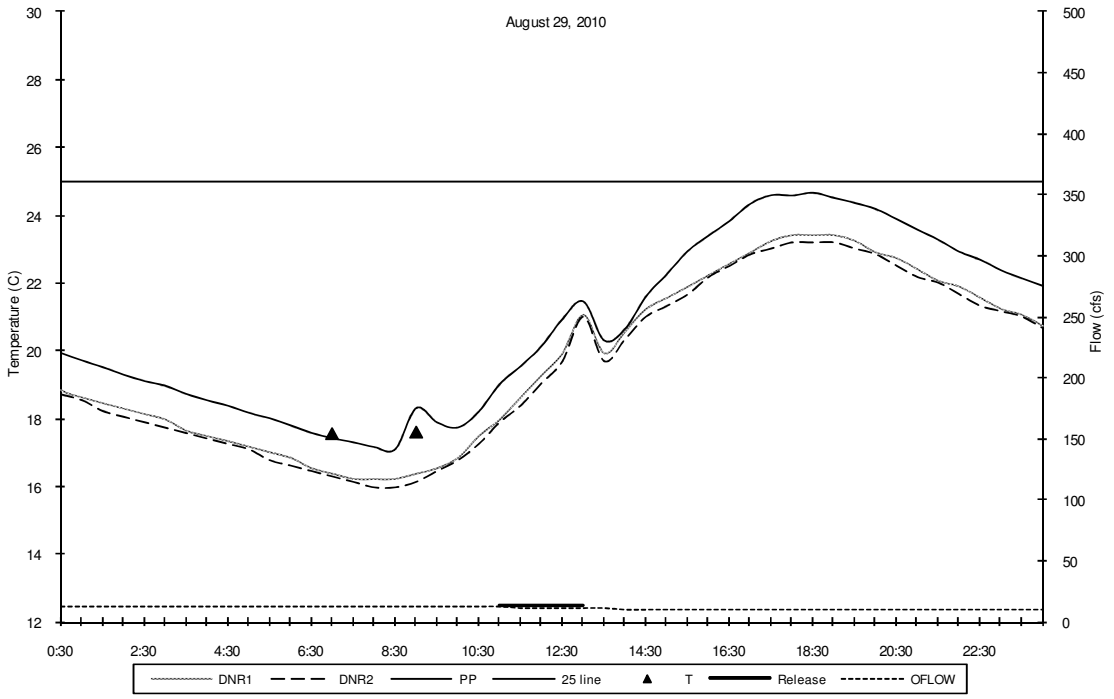
P7	P9	P11	P12	P14	P15			PCLD	8
23.8	25.1	23	22.3	24.7	24.2	OFLOW	18.6	ECLD	8.9
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	20	SMAX	23.2
23.6	23.3	23.6	23.5	23.4	23.6	EMAX	25.6	SWAMAX	23.8
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX		STIME25	
23.8	25.1	23	23.3	24.7	24.2	TAIR	24.4	STIMEMAX	



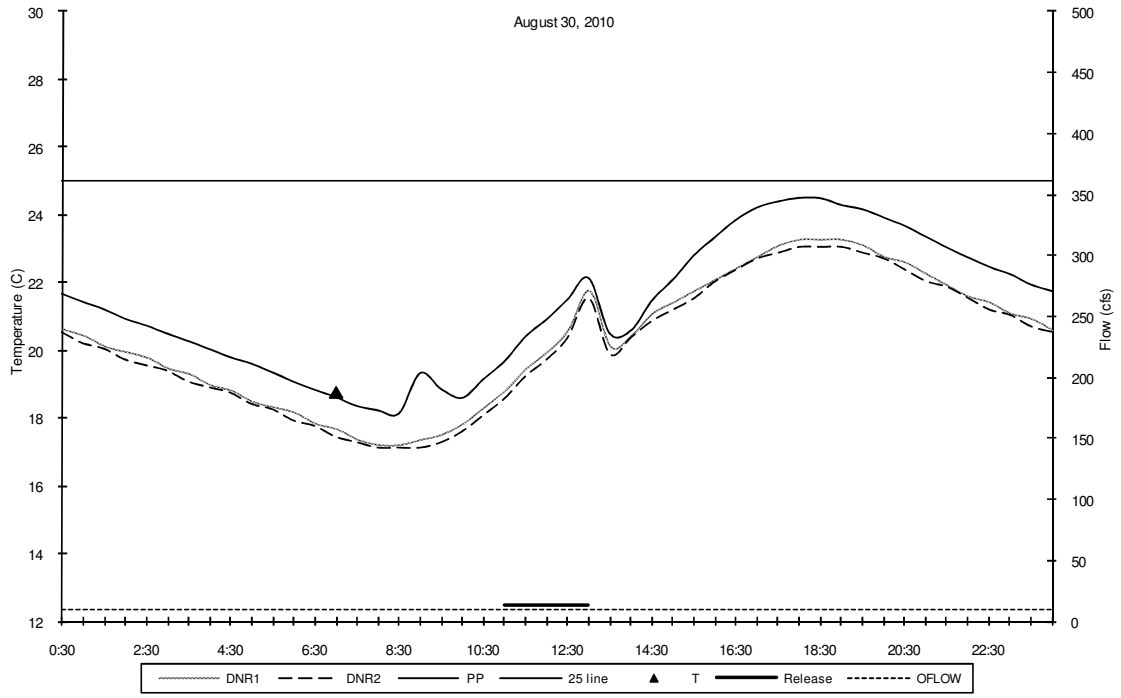
P7	P9	P11	P12	P14	P15			PCLD	6
24.5	23.8	24.3	24.6	24.2	24.4	OFLOW	15.1	ECLD	8.4
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	16	SMAX	23.1
23.5	22.8	23.3	23.4	23.4	23.5	EMAX	26.1	SWAMAX	24.3
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	24.4	STIME25	
24.5	23.8	24.3	24.6	24.2	24.4	TAIR	26.1	STIMEMAX	



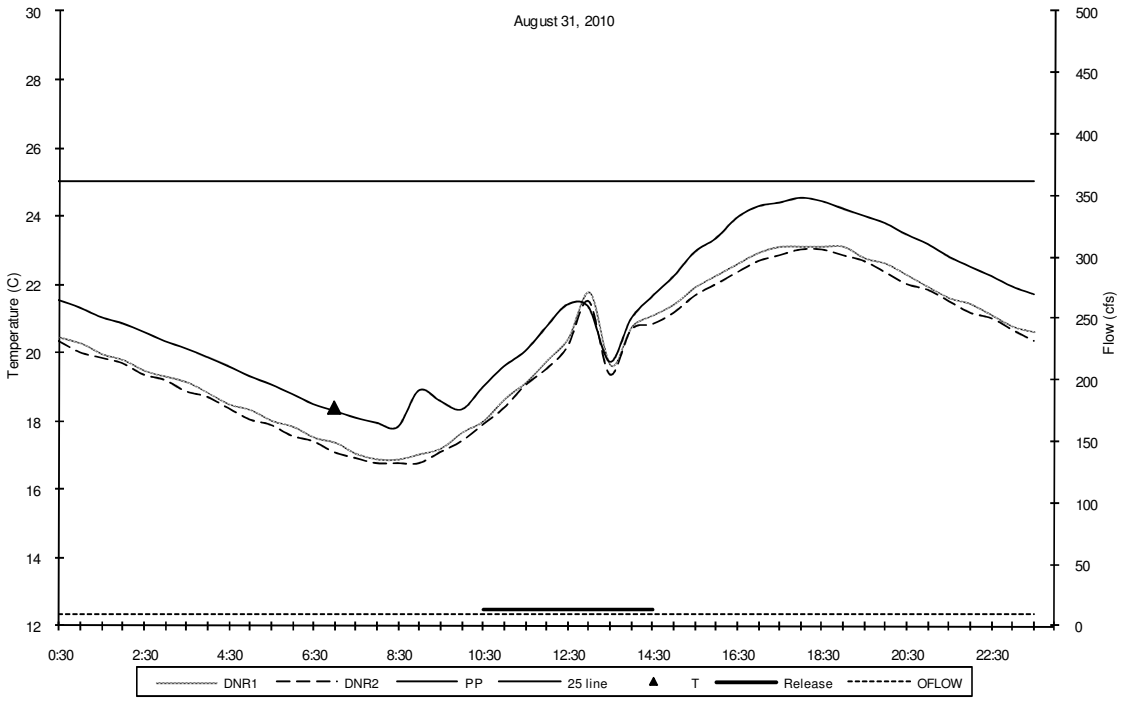
P7	P9	P11	P12	P14	P15	WhiteWater		PCLD	6
25	24.9	24.4	25	23.6	23.8	OFLOW	12.5	ECLD	8.6
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	13	SMAX	21.8
24.3	23.5	23.8	23.8	23.4	22.8	EMAX	29.4	SWAMAX	25.3
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	25.6	STIME25	
25	24.9	25.1	25	23.6	23.8	TAIR	28.3	STIMEMAX	



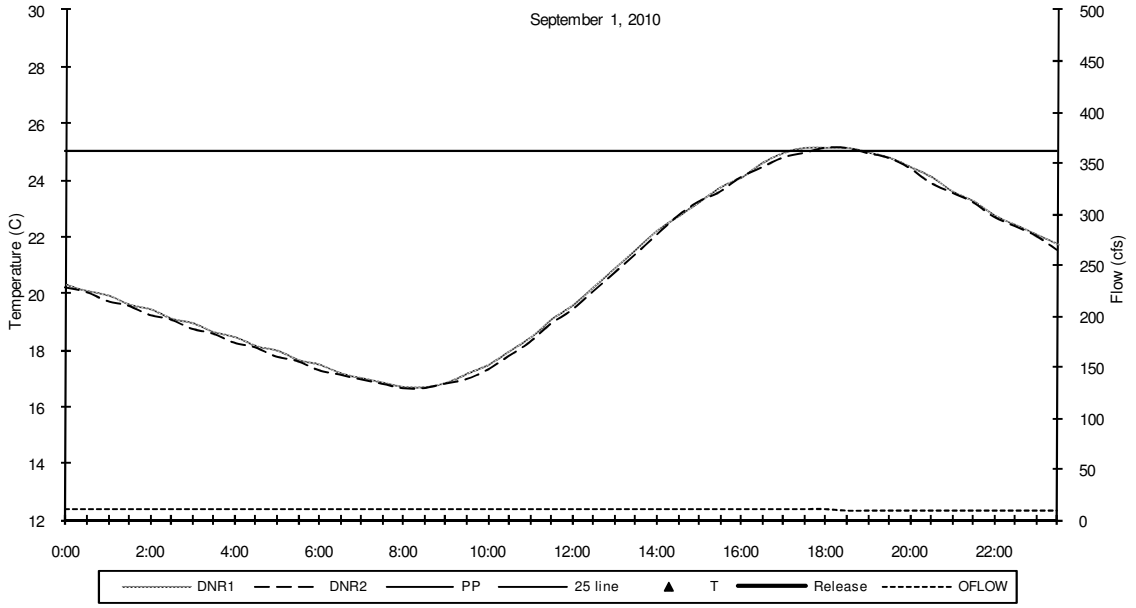
P7	P9	P11	P12	P14	P15	Temperature		PCLD	1
26.3	26.1					OFLOW	11.1	ECLD	7.1
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	12	SMAX	23.3
25.3	24.8	24.8	24.7	23	23.1	EMAX	30.6	SWAMAX	26.5
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	27.2	STIME25	
26.3	26.1					TAIR	29.4	STIMEMAX	

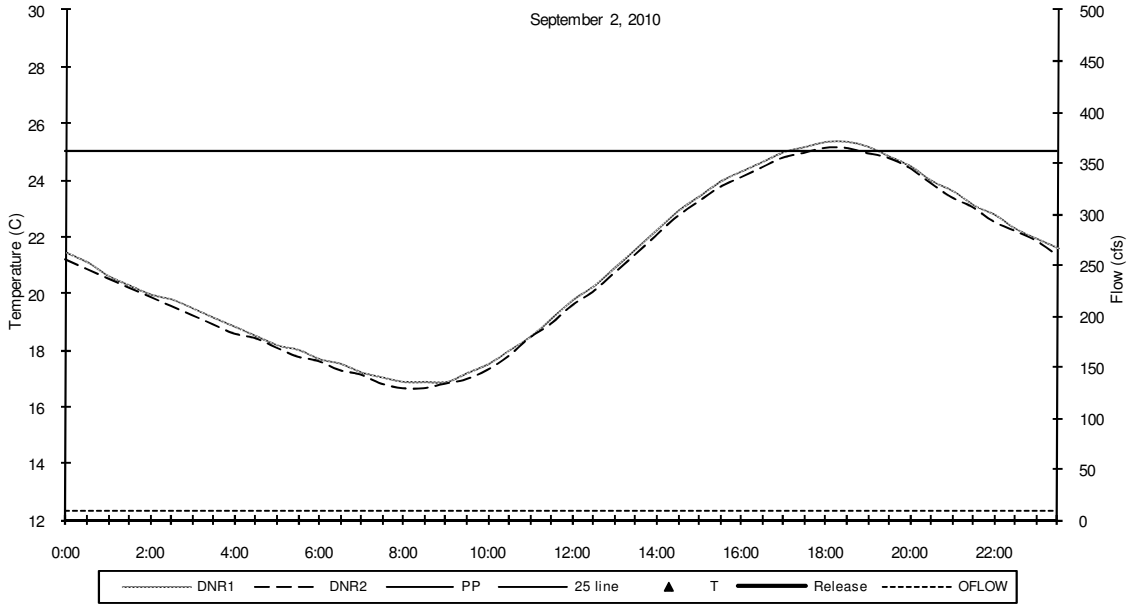


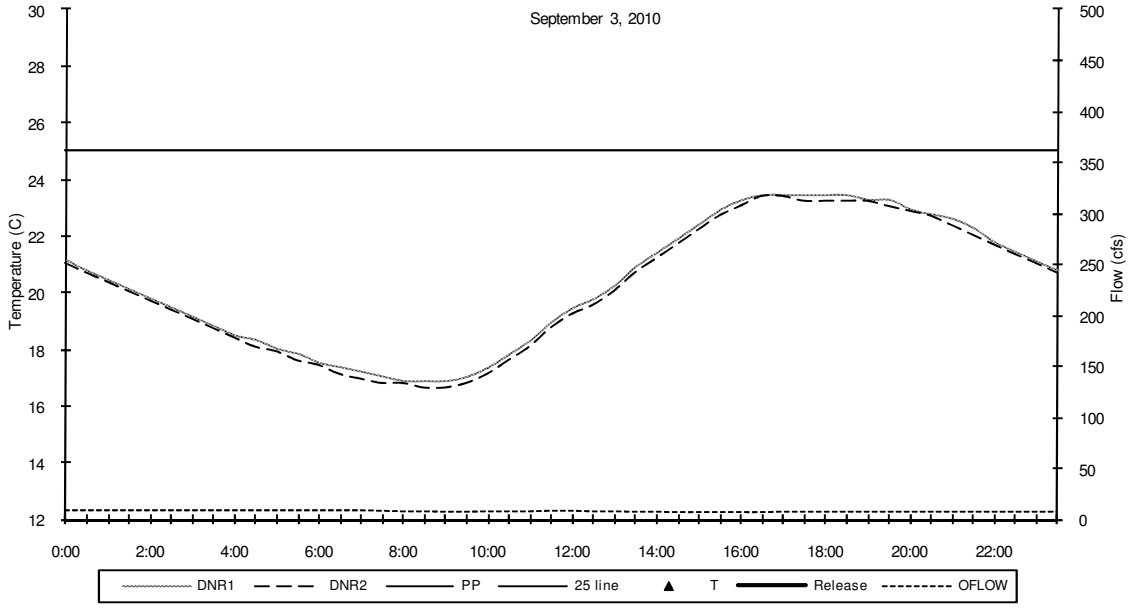
P7	P9	P11	P12	P14	P15	Temperature		PCLD	1
27.5						OFLOW	9.8	ECLD	7.1
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	10	SMAX	23.2
26.1	25.3	25.3	25.2	22.6	22.7	EMAX	31.7	SWAMAX	27.3
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	30.6	STIME25	
27.4						TAIR	31.7	STIMEMAX	

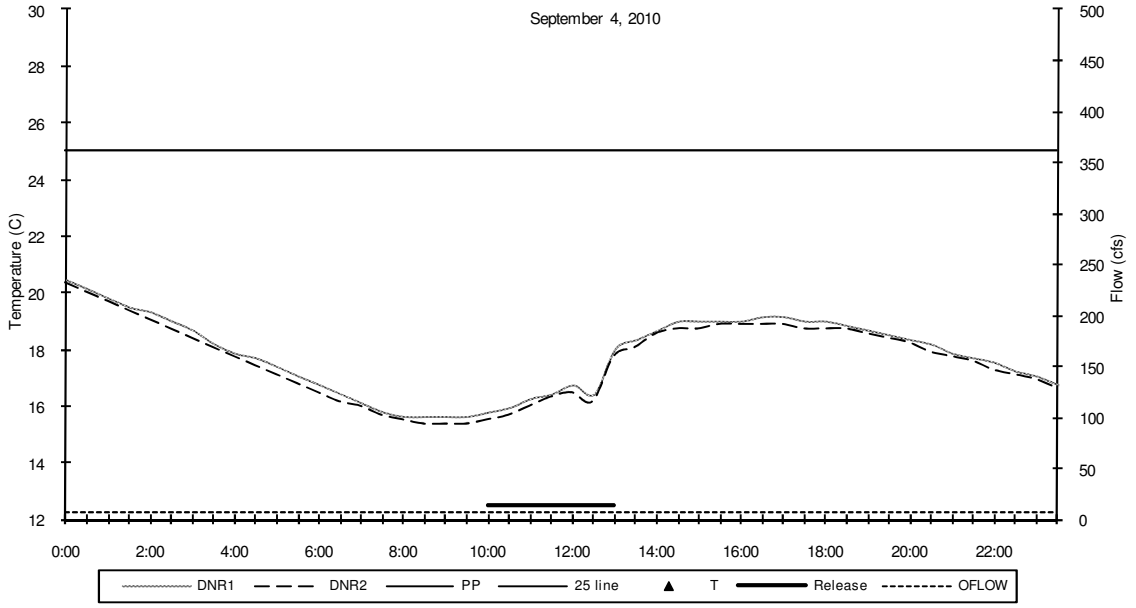


P7	P9	P11	P12	P14	P15	Temperature & Power		PCLD	1
27.3						OFLOW	9.8	ECLD	7.5
P7_A	P9_A	P11_A	P12_A	P14_A	P15_A	Q	10	SMAX	23.1
25.9	25	25.3	25.1	23.1	22.8	EMAX	31.7	SWAMAX	27.6
P7_B	P9_B	P11_B	P12_B	P14_B	P15_B	OMAX	31.1	STIME25	
27.3						TAIR	31.7	STIMEMAX	

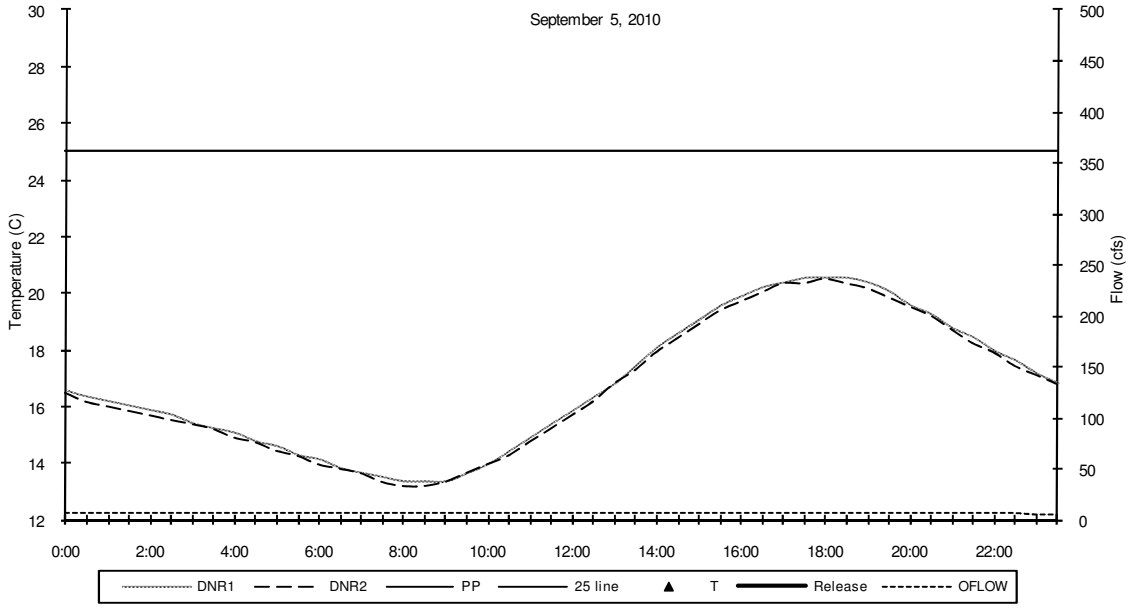

September 1, 2010
Temperature (C)
Flow (cfs)
30
28
26
24
22
20
18
16
14
12
500
450
400
350
300
250
200
150
100
50
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
DNR1
DNR2
PP
25 line
T
Release
OFLOW

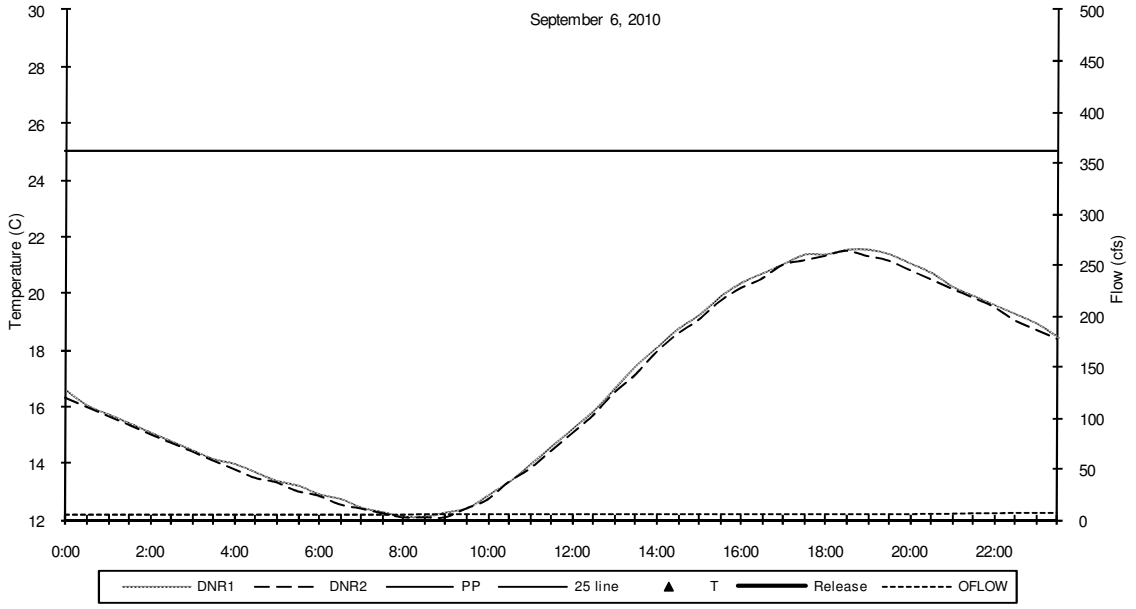

September 2, 2010
Temperature (C)
Flow (cfs)
30
28
26
24
22
20
18
16
14
12
500
450
400
350
300
250
200
150
100
50
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
DNR1
DNR2
PP
25 line
T
Release
OFLOW

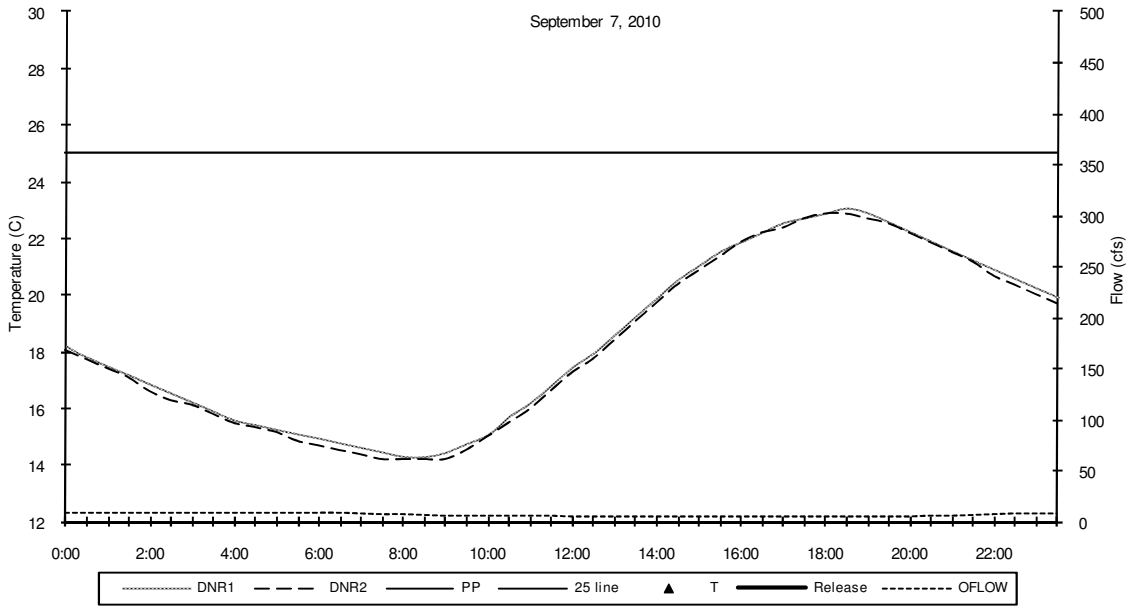


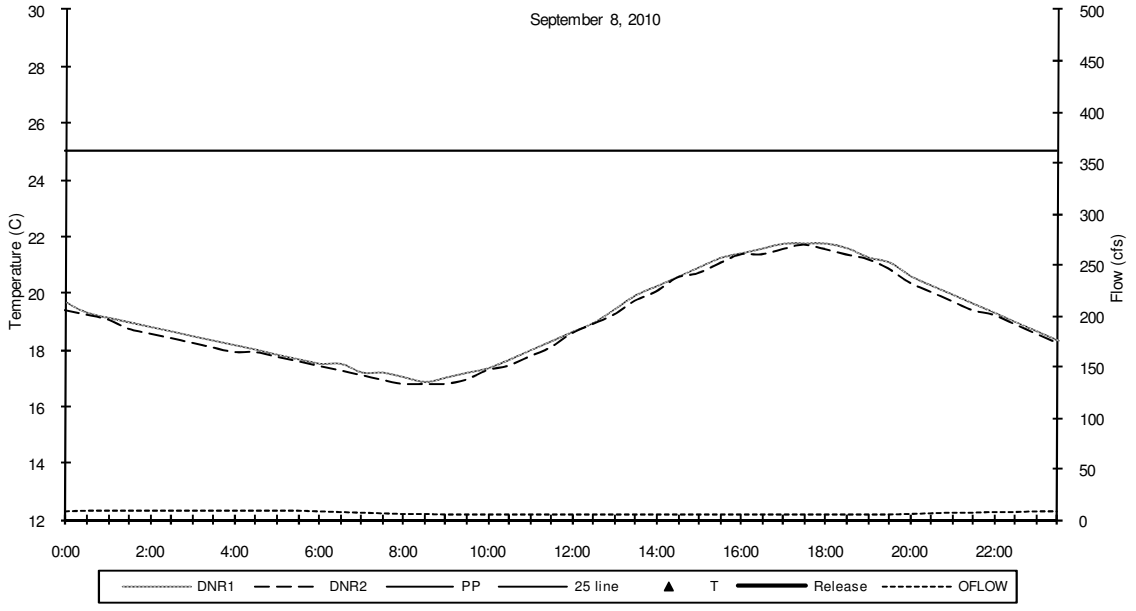


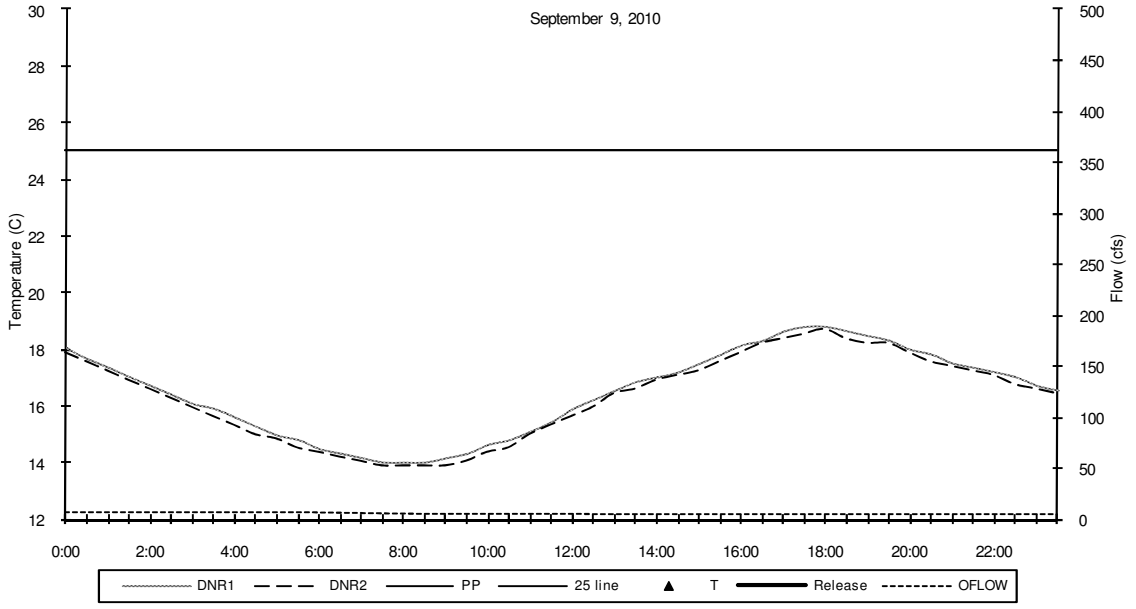
Whitewater Release

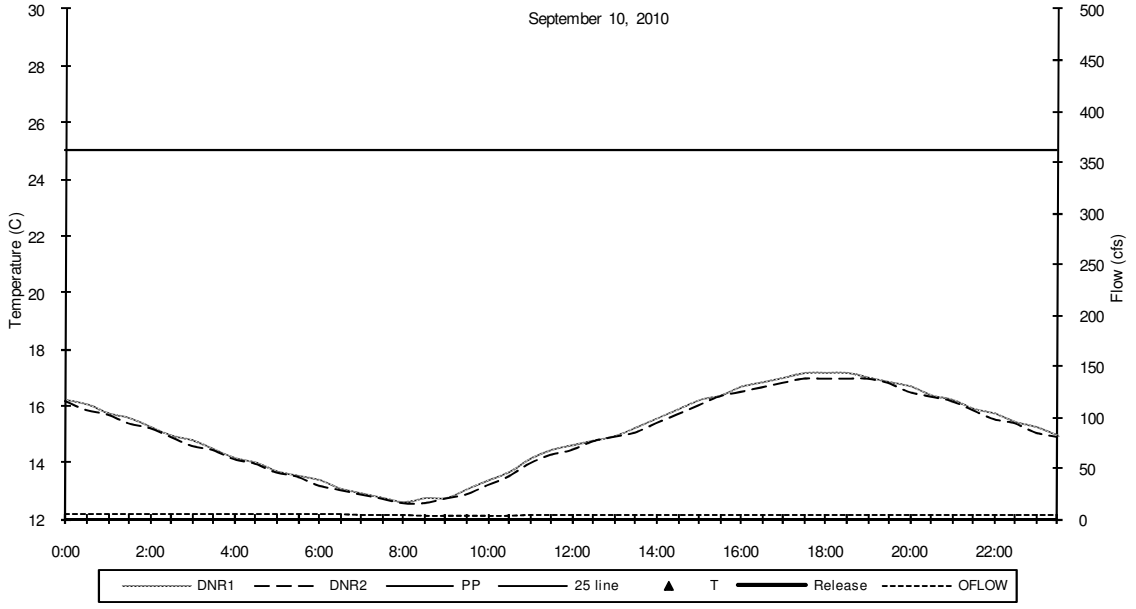

September 5, 2010
Temperature (C)
Flow (cfs)
30
28
26
24
22
20
18
16
14
12
500
450
400
350
300
250
200
150
100
50
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
DNR1
DNR2
PP
25 line
T
Release
OFLOW


September 6, 2010
Temperature (C)
Flow (cfs)
30
28
26
24
22
20
18
16
14
12
500
450
400
350
300
250
200
150
100
50
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
DNR1
DNR2
PP
25 line
T
Release
OFLOW


September 7, 2010
Temperature (C)
Flow (cfs)
30
28
26
24
22
20
18
16
14
12
500
450
400
350
300
250
200
150
100
50
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
DNR1
DNR2
PP
25 line
T
Release
OFLOW


September 8, 2010
Temperature (C)
Flow (cfs)
30
28
26
24
22
20
18
16
14
12
500
450
400
350
300
250
200
150
100
50
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
DNR1
DNR2
PP
25 line
T
Release
OFLOW


September 9, 2010
Temperature (C)
Flow (cfs)
30
28
26
24
22
20
18
16
14
12
500
450
400
350
300
250
200
150
100
50
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
DNR1
DNR2
PP
25 line
T
Release
OFLOW


September 10, 2010
Temperature (C)
Flow (cfs)
30
28
26
24
22
20
18
16
14
12
500
450
400
350
300
250
200
150
100
50
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
DNR1
DNR2
PP
25 line
T
Release
OFLOW

APPENDIX C

DEEP CREEK LAKE LEVEL ISSUES

Summer of 2010 was unusually hot and dry in western Maryland and resulted in lower than normal water levels in Deep Creek Lake. As a result, various interested parties requested MDE to evaluate the current operating rules for Deep Creek Hydroelectric Station and how the lake level is managed. This section summarizes lake level issues at Deep Creek Lake and how various uses of the lake affect water levels.

Figure C-1 shows the current Deep Creek Lake operating rule band, developed in the early 1990s as part of the state's water appropriate permit. It was developed with considerable input from a variety of interests and considering certain operating constraints on the lake and the power plant, as summarized below.

1. Ideal lake levels are above 2458 ft June to October (some ramps and coves get too shallow below 2458)
2. Lake level should not exceed 2461 ft to avoid flows over spillway
3. Lake level must be below 2457.9 in winter to avoid ice damage to spillway

Summary of Permit Operating Rules

1. Maintain lake levels within rule bands (except for emergencies)
2. Keep Youghiogheny River below 25°C (77°F) June-August using 1-2 hour turbine releases when needed, even if below LRB
3. Augment Youghiogheny River flow at the power plant discharge to maintain a total of 40 cfs with releases when needed
4. Whitewater releases
    - Generally 3-hr releases on Mondays, Fridays, Saturdays from mid-April to mid-October
    - M, F releases cancelled when lake reaches LRB
    - Sat. releases cancelled when lake reaches LRB-1

Only in dry years (1999, 2010) did lake levels fall below the LRB for more than a small number of days during summer months (in early June of 1999 and by August of 2010 – Figure C-2.) The contribution of various release types to the volume of water released from the lake varied with the type of hydrologic year (Figure C-3). In dry and average years, whitewater releases made up 43% to 46% of the volume of releases. Temperature enhancement releases were 40% of release volume in 1999 and 23% in 2010 (dry years), 14% in 2005 (average) and 4% in 2008 (wet). Minimum flow release volume ranged from 13% in the driest year (1999) to 1% in average and wet years, and was 4% in 2010. Discretionary power releases were 69% in a wet year but less than 4% in a very dry year. The complete record of summer lake levels is shown in Figures C-4 to C-6.

In June through August of 2010, lake levels were below the LRB 23% of the time as compared with 87% of the time in those months in 1999; levels were rarely below the LRB in others years since 1994 when the current operating rules first went into effect (Table C-1). The percentage of time that lake levels were close to the LRB (between 0.5 and 0.1 ft above the LRB) during June through August was calculated for years from 1994 to 2010 (Table C-2). Levels in 2010 were close to the LRB 64% of the time; during 4 other years (1995, 1999, 2002 and 2007) levels were close to the LRB more than 64% of the time during those summer months.

Minor changes to the temperature enhancement protocol were made in 2009 in response to previous recommendations based on operation of the protocol from 1995 to 2006. Among these changes was a reduction in the first prediction temperature below which the protocol would not need to be implemented, from 23°C to 20°C. The 23°C value was originally chosen to reduce the need for monitoring of river temperature when the weather was cool but was based on limited data available when the protocol was developed in 1994. Based on data from 1994 to 2010, we determined that this threshold was too high and resulted in some temperature exceedances. We estimated that an additional 1.4 days of releases per year (range: 0 to 3 days) would be needed for this change. Another minor change to the protocol is an increase in the baseline river flow threshold above which a temperature release is not needed or would not be effective, from 100 cfs to 150 cfs. The original flow threshold was based on limited data in 1994 which showed no temperature exceedances above a base flow of 100 cfs in the Youghiogheny as measured at the Oakland gage. We estimated an additional 1.3 days of releases per year (range: 0 to 7) would be needed for this change. Both changes together are estimated to result in about 2.7 additional days of releases per year. In terms of lake level, 2.7 additional releases is equivalent to less than 1 inch of lake depth.

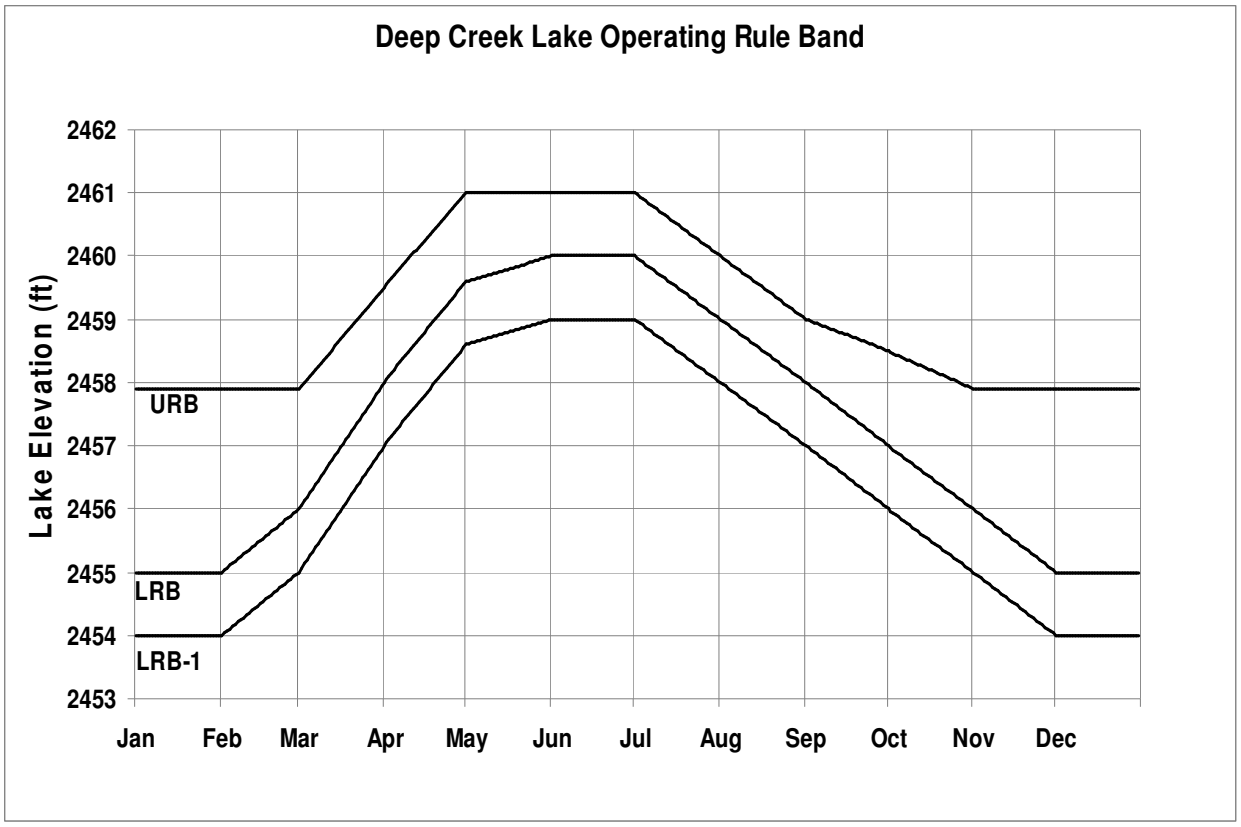


Figure C-1. Deep Creek Lake Level Operating Rule Band. URB = Upper Rule Band; LRB = Lower Rule Band; LRB-1 = 1ft below the Lower Rule Band.

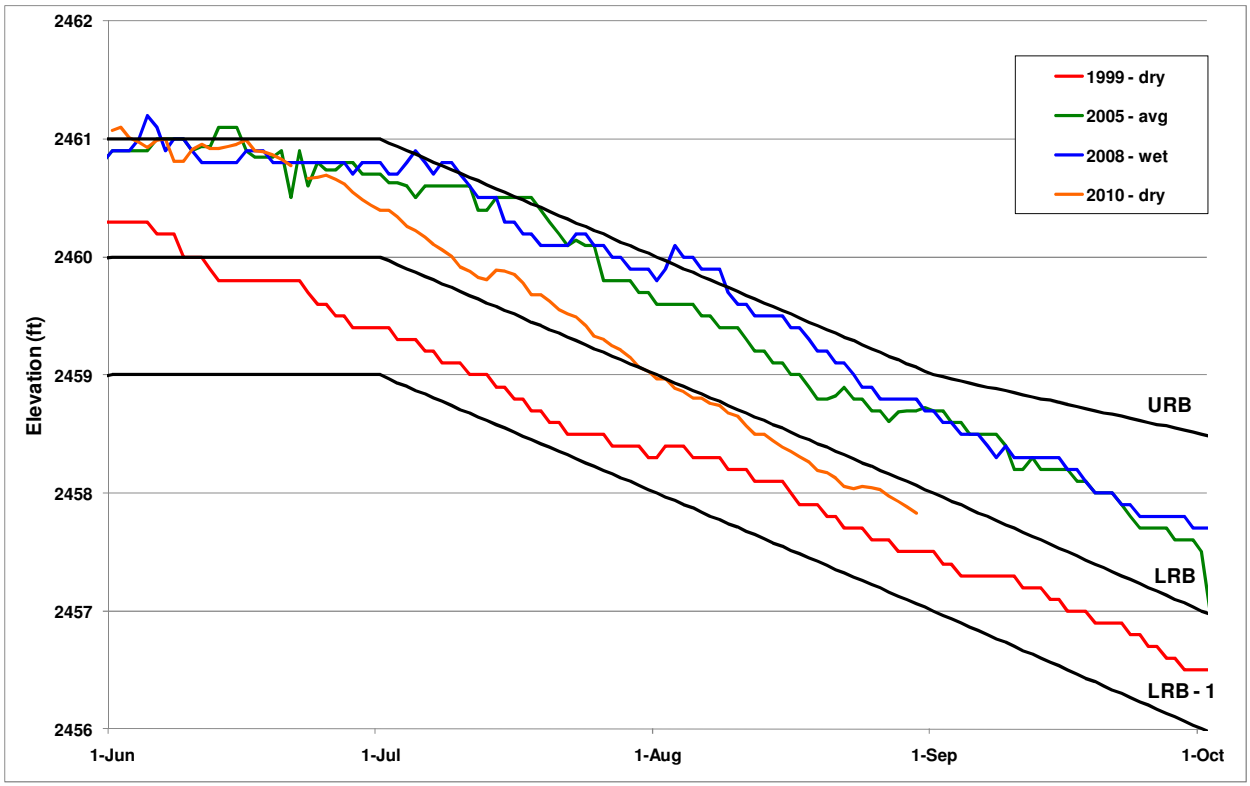


Figure C-2. Deep Creek lake levels (ft) in June to September for dry years 1999 and 2010, wet year 2008, and average year 2005. Data for 2010 is provisional and only provided to August 31.

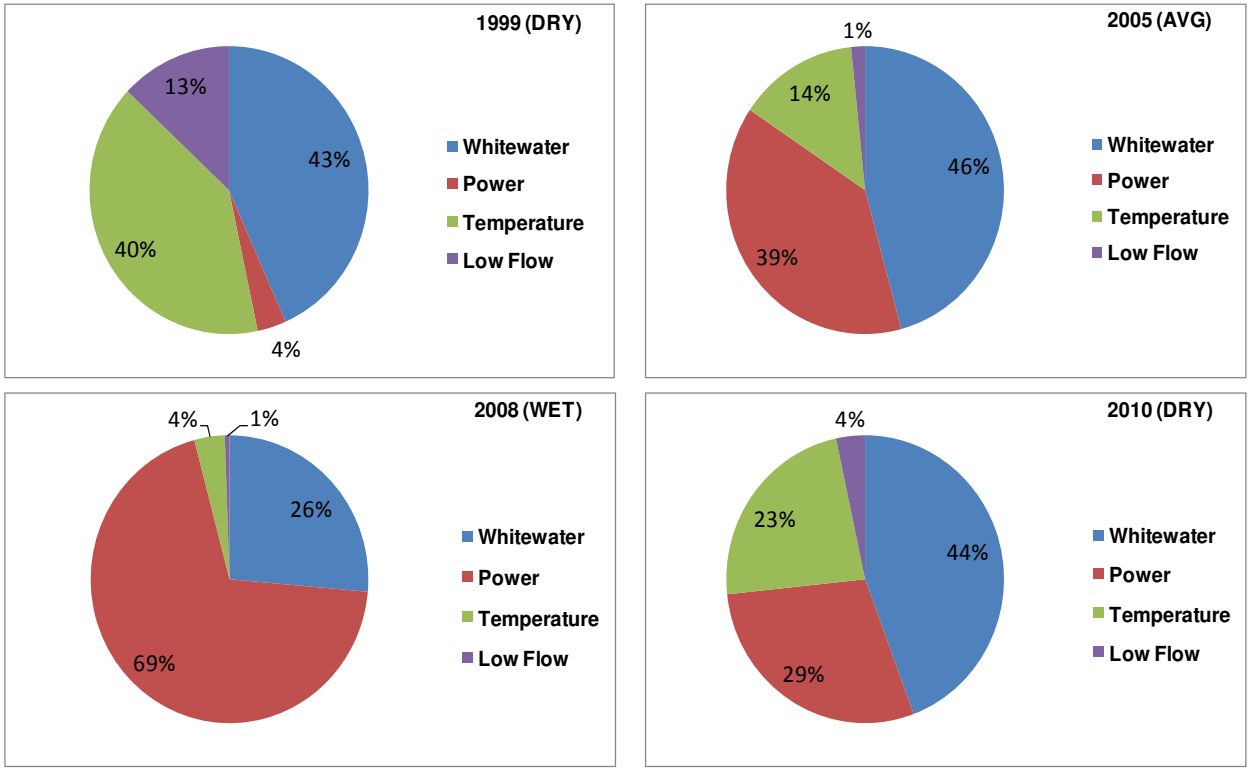


Figure C-3. Percentages of Deep Creek Lake flow (cfs) from different release types during the months of June, July, and August for years 1999 (dry rainfall year), 2005 (average rainfall year), 2008 (high rainfall year), and 2010 (dry rainfall year).

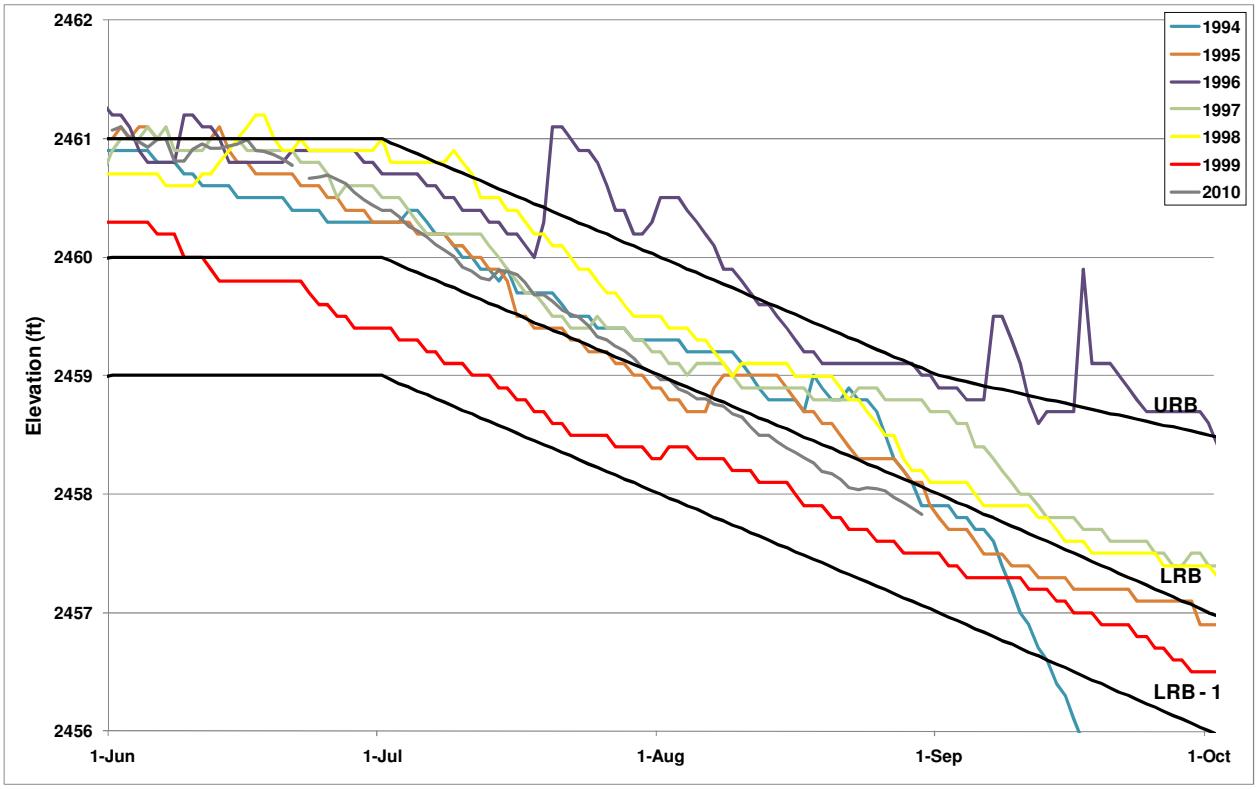


Figure C-4. Deep Creek lake levels (ft) in June to September 1994-1999 and 2010. Data for 2010 is provisional and only provided to August 31.

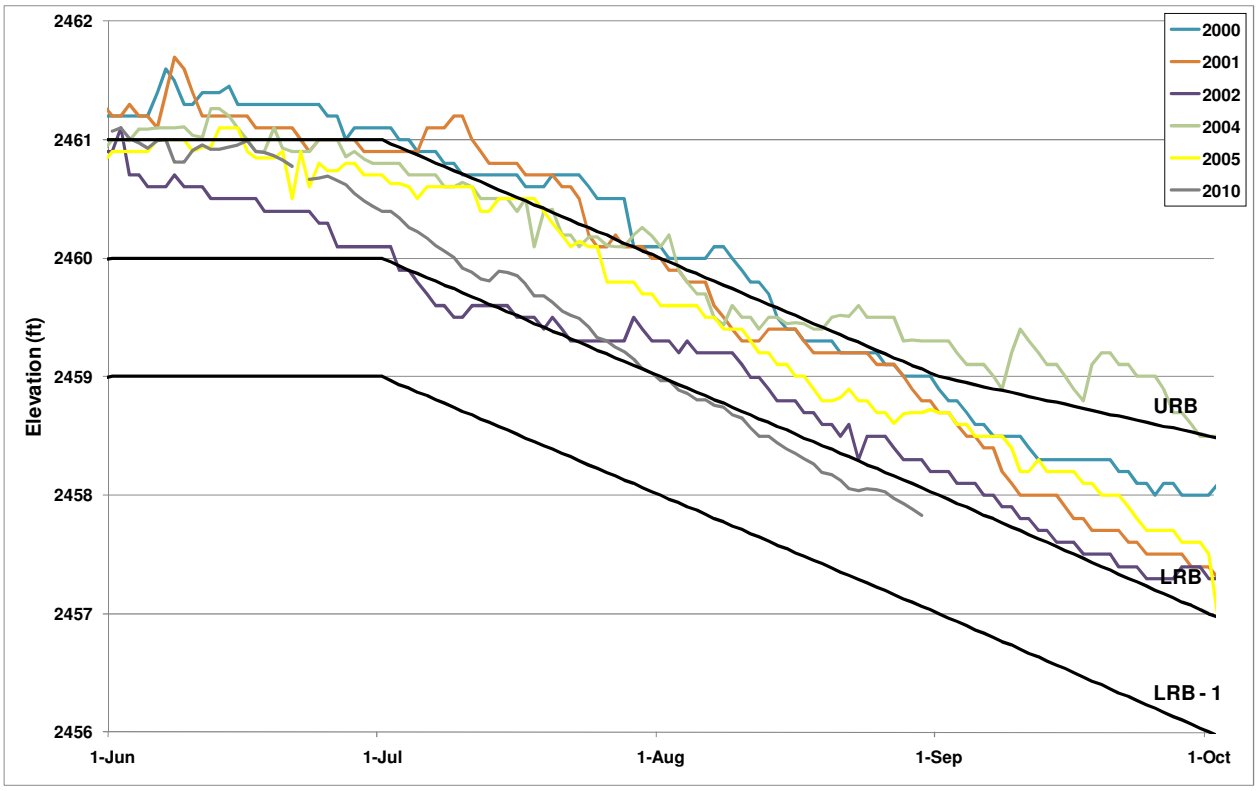


Figure C-5. Deep Creek lake levels (ft) in June to September 2000-2005 and 2010. Data for 2010 is provisional and only provided to August 31.

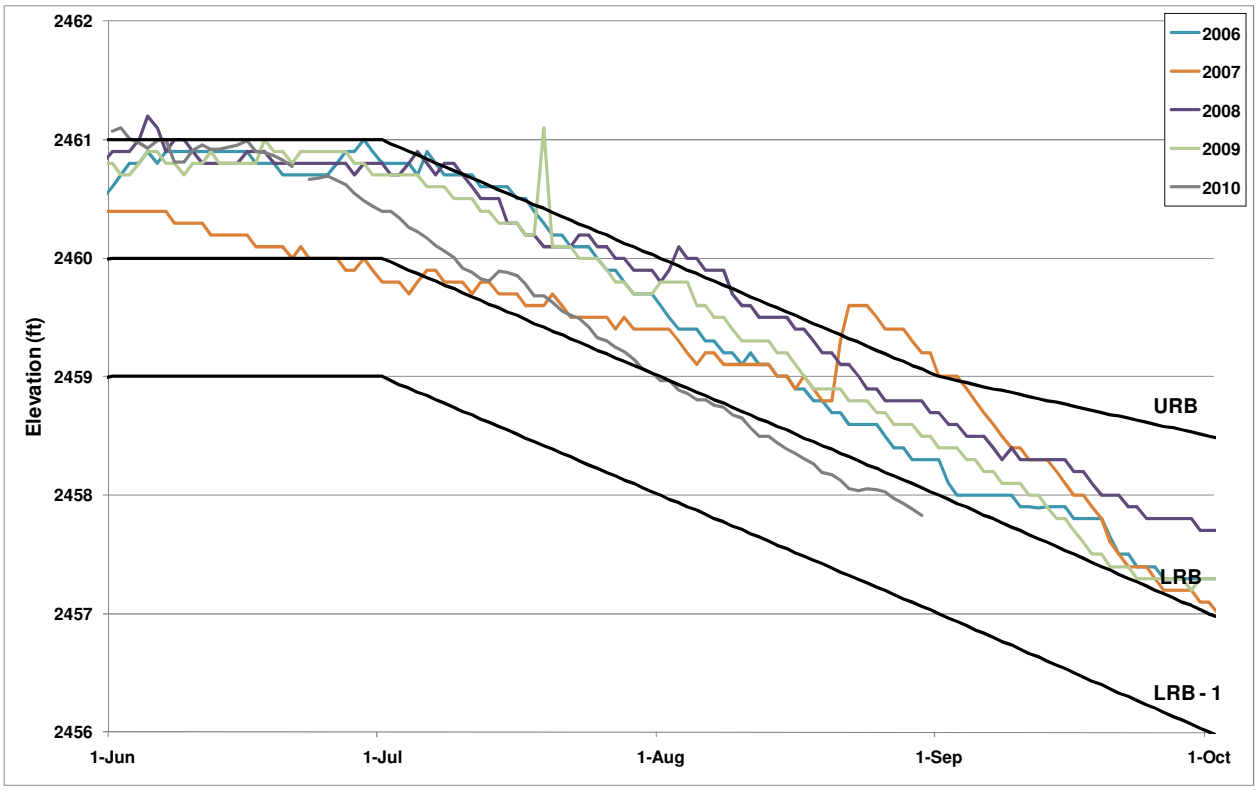


Figure C-6. Deep Creek lake levels (ft) in June to September 2006-2010. Data for 2010 is provisional and only provided to August 31.

Table C-1. Percentage of days in years 1994-2010 when lake level (ft) was 0.1 ft or more below the lower rule band per month; except as noted blank values indicate zero percent.

% of Days																	
	Lake Level Less than 0.1 ft Below Lower Rule Band																
Month	94	95	96	97	98	99	00	01	02	03*	04	05	06	07	08	09	10**
Jan														3			
Feb																	
Mar	13												23			10	
Apr				30									73				
May				52					6								
June						60											
July		3				100			16					13			
Aug	6	19				100											68
Sep	90	80				100											
Oct	100					35								74			
Nov	97													68			
Dec	16						6						3				
Jun-Aug	2	8				87			5					4			23
Total	27	8		7		33	1		2				8	13		1	

*Missing 2003 Lake Level Data
**2010 data is incomplete having provisional data for only June, July, and August

Table C-2. Percentage of day in years 1994-2010 when lake level (ft) was between 0.5ft and 0.1 ft above the lower rule band per month; except as noted blank values indicate zero percent.

% of Days																	
	Lake Level was Between 0.5ft and 0.1 ft Above Lower Rule Band																
Month	94	95	96	97	98	99	00	01	02	03*	04	05	06	07	08	09	10**
Jan													3	3			
Feb					25		7						100	25			
Mar	42												100			58	
Apr		47		67							3		87			30	
May		35		81		10			6				45				
June	20	3				100			23					77			
July	87	97		61		100			97					100			90
Aug	68	97		58	35	100			94			3	52	32			100
Sep	100	100		67	100	100		63	100				97	37		77	
Oct	100	94		94	26	100		74	13			3	13	100		35	
Nov	97			6			6	3						90			
Dec	29						19						3				
Jun-Aug	59	66		40	12	100			72			1	17	70			64
Total	46	40		36	15	43	3	12	28			1	41	39		17	

*Missing 2003 Lake Level Data
** 2010 data is incomplete having provisional data for only June, July, and August