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7 March 2005

Brian Kooiker  
Discharge Permits Section  
Vermont Department of Environmental Conservation  
Vermont Agency of Natural Resources  
Wastewater Management Division  
103 South Main Street – Sewing Building  
Waterbury, VT 05671-0405

**Re: NPDES Permit, VT0000264, No. 3-1199: Vermont Yankee Station  
Amendment Request**

Dear Brian:

This letter provides the additional information requested by Mr. Kenneth Cox in his correspondence to me dated January 28, 2005. The issues raised in Mr. Cox's letter were further discussed in the meeting with Mark Mattson of Normandeau Associates, Inc., Carol Carpenter and yourself, Ken Cox, Eric Palmer and me on February 15, 2005. Specifically, Mr. Cox sought: (1) additional verification of complete thermal mixing in the Vernon Dam tail waters, and (2) confirmation of the absence of an effect of the expected thermal regime on Atlantic salmon smolt outmigrations. This letter finally and completely responds to these issues thus paving the way for a decision to be made by ANR on the pending NPDES permit amendment request (Request). We respectfully submit that the overwhelming weight of the scientific evidence supports the conclusion that Entergy Vermont Yankee has fully addressed all ANR inquiries in a manner that supports the agency's prompt grant of a Request made over two years ago.

A brief review of the unusual history of the Request is warranted. Entergy VY has comprehensively studied the River ecosystem for approximately three decades under the direction and oversight of ANR and the associated environmental advisory committee (EAC). The breadth and duration of assessment is relatively unique among power plants nationwide. Thus, much is known about the absence of effects of Entergy VY on the River. This dataset not only has provided ANR with confidence in its historic permit reviews, it now also provides ANR with a significant measure of confidence in its decision making for the Request.

This confidence is bolstered by the involvement of Versar, Inc. (Versar), an independent leading national expert selected by ANR to facilitate the expedited review of the Request. Versar's review affirmed the appropriateness of the Request and the absence of any potential adverse environmental impact to the balanced indigenous populations. Despite the use of Versar to facilitate the process, two years have elapsed since VY submitted its Request, and twenty months since Versar completed its review. While ANR biologists have been involved from the beginning in this effort, questions raised for the first time late in the review process have alone consumed in excess of a year in protracted discussions. Entergy VY believes that the substance of these issues actually was resolved in the earlier stages of data collection and analysis, as confirmed by Versar, and the conclusions remain unchanged despite the passage of time. It is

our belief that continuing opposition from within the agency could occur only by ignoring the overwhelming weight of scientific evidence provided by Entergy VY and concurred with by Versar.

As you know, VY's Request is to allow the calculated delta T be increased by 1°F when ambient temperatures are between 55°F and 78°F, during the period May 16 through October 14. As you also know, Versar concluded on May 9, 2003, in its final comprehensive third party review of VY's 316a Demonstration, that *"This request is a very small change in the thermal regime, as is noted repeatedly within the Demonstration, and it is not imposed when temperatures are at the minimum or maximum of the permitted temperature range, the biological consequences of such a small change in the thermal regime are likely to be equally small, and very difficult to both predict and measure. The approach taken in the Demonstration to predict the effects is an appropriate and rather innovative means of meeting this difficult challenge."* Versar further contemplated that *"if this were a request for a new permit, then predictions of impacts of the total discharge would be necessary and might have substantial uncertainty associated with them. However, VY has been the object of biological study for decades, and large databases exist from which an evaluation of whether current plant operations have had an adverse effect can be made"*. (Versar, Inc. May 9, 2003, page 36).

#### Issue 1 – Thermal Mixing in Vernon Dam Tail Waters

It is widely recognized among experts in hydrology and hydrodynamics, including with respect to flow and temperature, that hydroelectric facilities designed and configured like Vernon Dam ordinarily result in complete mixing of water. VY's 316a Demonstration itself was based on the best professional judgment of highly experienced hydrologists and hydrothermal modelers who concluded that River water temperatures, which are continuously monitored by VY at Station 3, are representative of the mixed temperature in the entire 0.65 mile long reach of the river between Vernon Dam downstream to Station 3. The reason, which resonates even to a layperson, is that the turbulence caused by water passing through the turbines, over the dam during spill conditions, and through the fish passage facilities when operated, itself causes complete mixing of River water in the Vernon Dam tailrace reach. Further, Versar, again the expert chosen by ANR to conduct the review based on its professional experience with 316a Demonstrations, concluded this to be the case in its *initial* review over twenty months ago. Further, in a subsequent review dated September 10, 2004, Versar again corroborated VY's judgment, reiterating, *"under most conditions, and especially during the high-flow spring and early summer spawning season, we believe the area below the dam would be nearly completely mixed with respect to the main flow coming over or through the dam."*

As Mr. Cox requested, however, VY has prepared and attached to this letter graphs (Figures 1-10) that show the continuous water temperature monitoring data and associated river flow and plant operating conditions recorded during the summer period 16 May through October 2004 from up to six depths at seven stations in the Vernon Dam tailrace.<sup>1</sup> These graphs confirm that except for brief transient episodes, as is to be expected, there is complete mixing at these stations during the summer period 16 May through 14 October 2004.

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<sup>1</sup> It is important to note that the finding made in VY's 316a Demonstration [that there is no prior appreciable harm to the balanced indigenous populations of fish and macroinvertebrates found in this tailrace reach of the Connecticut River] was not dependent on whether tailrace flows are completely mixed, nor should it be. That finding was appropriately based on the statistical analysis of inter-annual population trends for RIS using methods recommended by Versar and agreed to by ANR.

In interpreting any presentation of water temperature from the 16 May through 14 October 2004 study, including the attached Figures 1-10 and Table 1, it should be noted that the manufacturer's reported operating accuracy for the Onset StowAway® Tidbit® 32k temperature loggers deployed in this study was  $\pm 0.4^{\circ}\text{C}$ , which means that temperature differences of up to  $0.8^{\circ}\text{C}$  can be attributed solely to instrument measurement variation and not to true differences in the river water temperature. Occasional surface stratification of up to about  $1^{\circ}\text{C}$  ( $1.8^{\circ}\text{F}$ ) warmer than the measurement precision was observed at the downstream-most stations for some time intervals (Figures 1-7). For Stations S1-2, S1-3, S2-1, and S3-1 (Figures 1-4 and Figure 10), there were no temperature values observed outside the measurement precision of  $0.8^{\circ}\text{C}$  during the entire summer period monitored. At Station S3-3, there were 24, 15-minute observation intervals when the water temperature was  $1^{\circ}\text{C}$  warmer than the measurement precision from top to bottom, and 200, 15-minute observation intervals when the water temperature was between  $1^{\circ}\text{C}$  and  $0.5^{\circ}\text{C}$  warmer from top to bottom. Since observation intervals were 15 minutes, this means that there were 6 hours out of 2,964 hours when a  $1^{\circ}\text{C}$  stratification and 50 hours out of 2,964 when a  $0.5^{\circ}\text{C}$  stratification occurred at Station S3-3. Water temperature stratification of  $0.1^{\circ}\text{C}$  to  $0.5^{\circ}\text{C}$  beyond the measurement precision was observed for 24, 15-minute intervals at Station S4-1, which is located over one mile downstream of Vernon Dam and is more representative of conditions in Turners Falls headpond than in the Vernon Dam tail waters found between the foot of Vernon Dam and Station 3. At Station S4-2, also more than a mile downstream of Vernon Dam, there were 21, 15-minute observation intervals (5.25 hours) when the water temperature was  $1^{\circ}\text{C}$  warmer than the measurement precision from top to bottom, and 36 additional observation intervals (9 hours) when the water temperature was between  $1^{\circ}\text{C}$  and  $0.5^{\circ}\text{C}$  warmer from top to bottom out of 2,961 total hours of temperature monitoring. *This stratification is of the type one would normally expect to see as the turbulent Vernon tailrace water flows downstream into the Turners Falls impoundment and are subjected to atmospheric warming.* In addition, as requested by Eric Palmer at the 15 February 2004 meeting, attached Table 1 portrays the mean water temperature and associated summary statistics for each water temperature monitoring station and depth in the Vernon Dam tail waters from which a complete and consistent data set of 14,592 temperature readings was collected at 15-minute intervals for a period of 152 days between 16 May through 14 October 2004. The mean water temperatures observed at each of these 13 different monitoring locations that were spread out along more than one mile of tailrace habitat varied from a high of  $21.0^{\circ}\text{C}$  at five locations to a low of  $20.6^{\circ}\text{C}$  at one location. Thus, the observed range of mean river water temperatures (Table 1) falls within the measurement error for the instrumentation. This data and analysis confirms that the Vernon Dam tail waters are completely mixed during the summer permit period. This conclusion is wholly in accordance with the initial conclusions of VY's 316a Demonstration and Versar's review of it.

## **Issue 2 – Third Permit Period for Salmon Smolt Outmigrations**

The second issue regards the potential effects of the Request on smolt outmigrations. As VY repeatedly has demonstrated, neither the data nor the known science of smolt behavior and physiological traits justifies this concern, nor does it provide any basis to alter the Request. As no one at the agency has disputed, the Vernon Pool and the Vernon Dam tail waters are not salmon parr or smolt rearing habitat. Rather, as independent regulatory assessment has concluded, these sections of the River provide a travel corridor for outmigrating Atlantic salmon smolts in the spring and for immigrating adults in the spring and early summer (Gephard and McMenemy 2004). Thus, it appears that the lingering concern is that outmigrating smolts may be delayed or blocked from passage through Vernon Dam by the presence of Entergy VY's thermal plume, causing them to remain in the lower Vernon Pool too long to complete their outmigration to Atlantic coastal waters. Salmon smolts that are delayed too long in freshwater during

their outmigration are reported to lose some of their developed smolt characteristics related to their tolerance of oceanic salinity, and to revert to their freshwater physiological state in a process referred to as residualism (Duston et al. 1991; McCormick et al. 1999).

No concern about residualism is justified in this case. It is well settled among fisheries biologists that residualism requires several *weeks* of exposure to river water temperatures above 50°F. Yet, a specific study of the outmigration of Connecticut River salmon smolts performed 14-27 May 1994 at the Vernon Dam forebay with water temperatures of 50.9° – 69°F demonstrated that smolts only reside in the lower Vernon Pool (and therefore could only be exposed to Entergy VY's plume) for an average of 8 hours 53 minutes. This conclusion is based on the analysis of data from 113 radio-tagged fish released just upstream of Entergy VY's plume in May 1994.

Further, an examination of the frequency of travel times in May 1994 from the release point just upstream from Entergy VY's plume downstream and into the Vernon Dam tail waters (Figure 11) revealed that more than one-third of the fish (41/113) passed in 4 hours; more than one-half of the fish (74/113) passed in 12 hours; and 92% of the fish (104/113) passed in 36 hours. The 1994 study was one of three telemetry studies performed by New England Power (now US Gen), a competitor of Entergy VY, to evaluate smolt passage past Entergy VY's discharge and downstream through Vernon Dam. New England Power conducted three studies in May 1994, May 1995, and early June 1996 in Vernon Pool. Each had large sample sizes (N = 177, 173, and 88 radio-tagged smolts, respectively) and specifically addressed the presence of VY's plume in the design by selecting release points that were all upstream from the plume and by monitoring the approach and passage of these tagged fish through Vernon Dam with respect to east, middle or west thirds of the river. The cumulative frequency of occurrence of travel times in the Vernon Dam forebay for these three telemetry studies (Figure 12) revealed that more than 54% of the smolts resided in lower Vernon Pool for less than 4 hours before passing downstream through the dam. More than 78% of these smolts passed downstream in less than 12 hours, and only one slow moving fish required slightly less than four days to pass downstream through Vernon Dam. Therefore, the preponderance of the reasonably available migration rate data from these extensive studies over three years demonstrate that the Atlantic salmon smolt outmigration rate is not significantly affected by Entergy VY's thermal plume. Accordingly, there is no legitimate scientific basis for concern about Atlantic salmon smolt outmigration at the Vernon Dam.

In conclusion, the information provided at the 15 February 2005 meeting and in this letter and its attachments provides ANR with an overwhelming weight of scientific evidence to resolve any lingering concerns as to these issues.


Entergy VY asks only that your analysis of these issues be governed by a standard of reasonableness based upon the record of evidence. Agency biologists involved in the review of Entergy VY's 316(a) Demonstration and the significant additional information provided during the past two years have themselves provided no evidence to dispute the conclusions of the Demonstration and Versar on these issues. Entergy VY has taken every opportunity to understand and address these concerns and to respond in a manner that eliminates any reasonable basis for continuing concern.

We respectfully request that ANR undertake to resolve this matter at the earliest opportunity, especially in light of the expediting agreement entered over two years ago. My understanding is that the leadership of ANR has or will be meeting in the next few days to discuss these issues, and Entergy has requested to

meet with Commissioner Wennberg, if needed, at his earliest convenience in order to clarify any of these issues. We appreciate your continued time and effort toward a final resolution.

Sincerely,

Entergy Nuclear Vermont Yankee, LLC

A handwritten signature in cursive script, appearing to read "Lynn DeWald".

Lynn DeWald  
Environmental Specialist

cc: Chuck D. Barlow, Assistant General Counsel – Environmental, Entergy Services, Inc.  
Brian Kooiker, Section Chief, Wastewater Management Division VT DEC  
Carol Carpenter, Environmental Analyst, Wastewater Management Division VT DEC  
Ken Cox, Fisheries Biologist, Vermont Fish and Wildlife Department  
Eric Palmer, Fisheries Biologist, Vermont Fish and Wildlife Department  
Wayne LaRoche, Commissioner, Vermont Fish and Wildlife Department  
Jeff Wennberg, Commissioner, Vermont Department of Environmental Conservation

**Table 1. Summary statistics for the mean water temperature observed in the Vernon Dam tail waters of the Connecticut River 16 May - 14 October 2004 for all Monitoring Stations with a consistent number of 14,592 observations.**

Station	Depth (m)	N	water temperature °C			
			Mean	Max	Min	Stdev
S1-2	0.25	14592	21.0	26.4	12.8	3.1
S1-2	0.50	14592	21.0	26.5	12.8	3.1
S1-2	1.00	14592	20.8	26.3	12.6	3.1
S1-2	2.00	14592	20.9	26.3	12.7	3.1
S1-3	2.00	14592	21.0	26.3	13.0	3.2
S1-3	bottom	14592	21.0	26.2	12.8	3.2
S2-2	0.25	14592	21.0	26.4	12.7	3.2
S3-1	0.25	14592	20.6	26.0	12.5	3.2
S3-1	0.50	14592	20.8	26.2	12.5	3.2
S3-1	1.00	14592	20.9	26.3	12.8	3.2
S3-1	2.00	14592	20.8	26.2	12.6	3.2
S4-1	4.00	14592	20.9	26.3	12.6	3.2
S4-1	bottom	14592	20.9	26.2	12.7	3.2

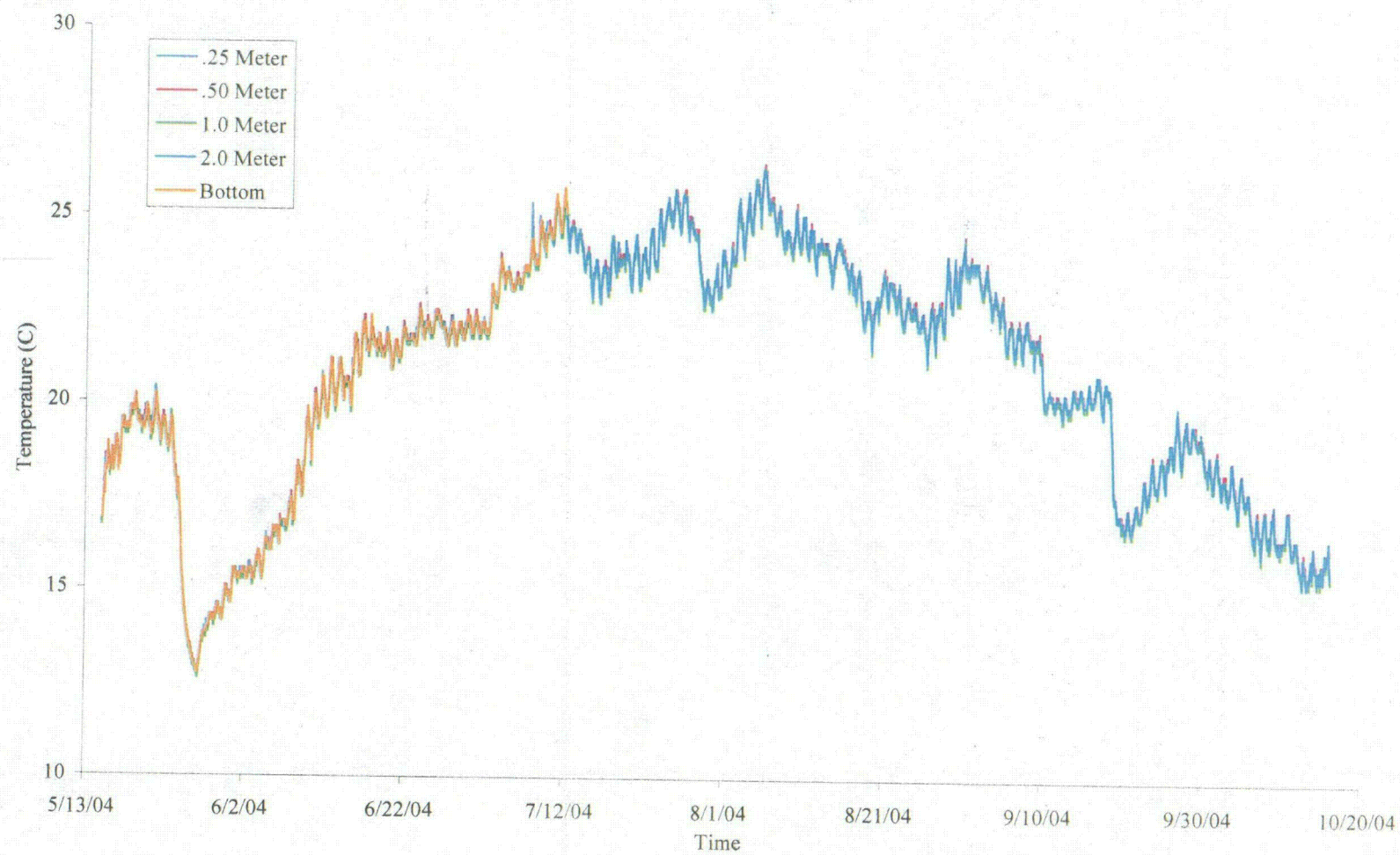


Figure 1. Temperature data from Station S1-2 downstream of Vernon Dam during summer permit conditions.



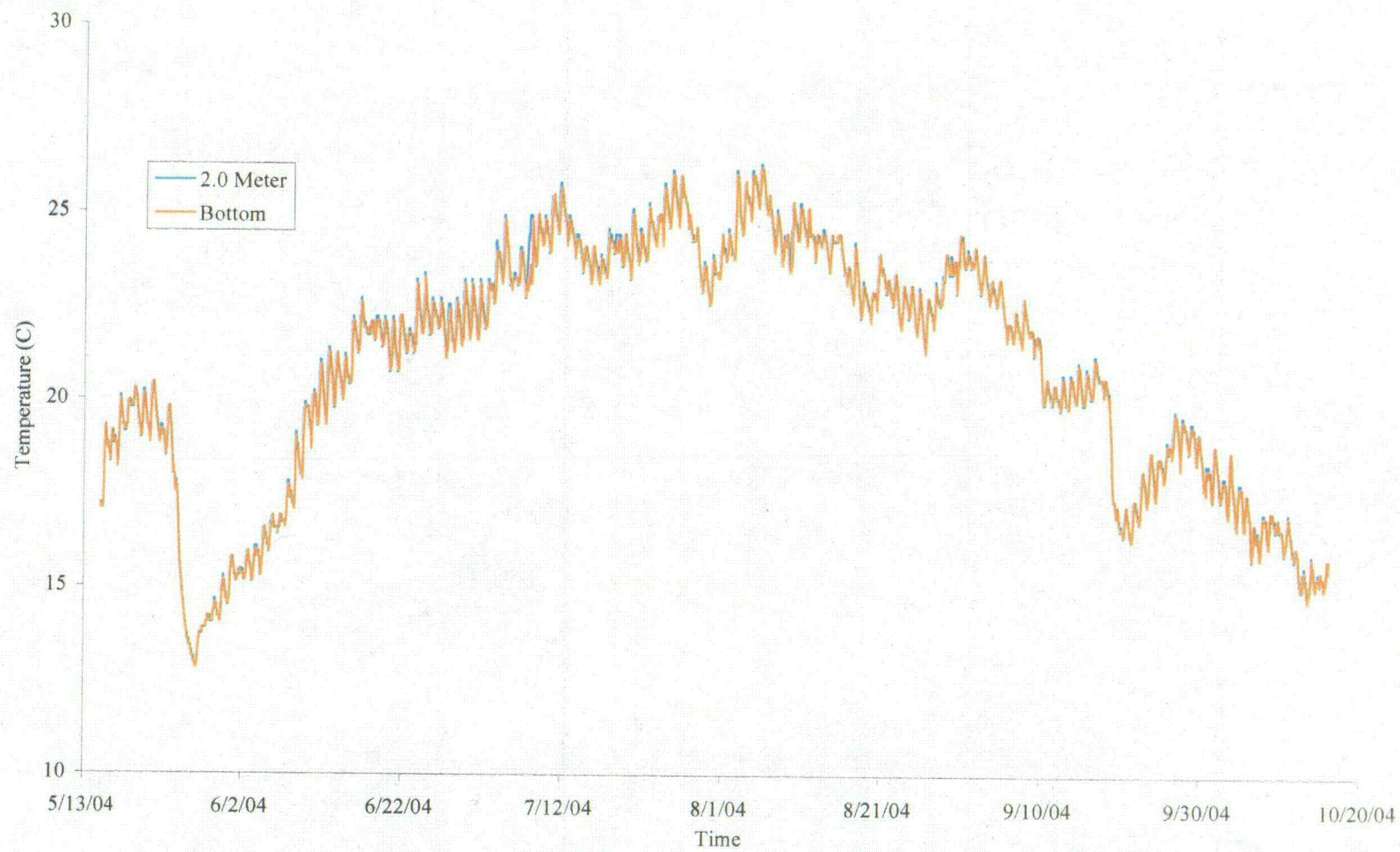


Figure 2. Temperature data from Station S1-3 downstream of Vernon Dam during summer permit conditions.



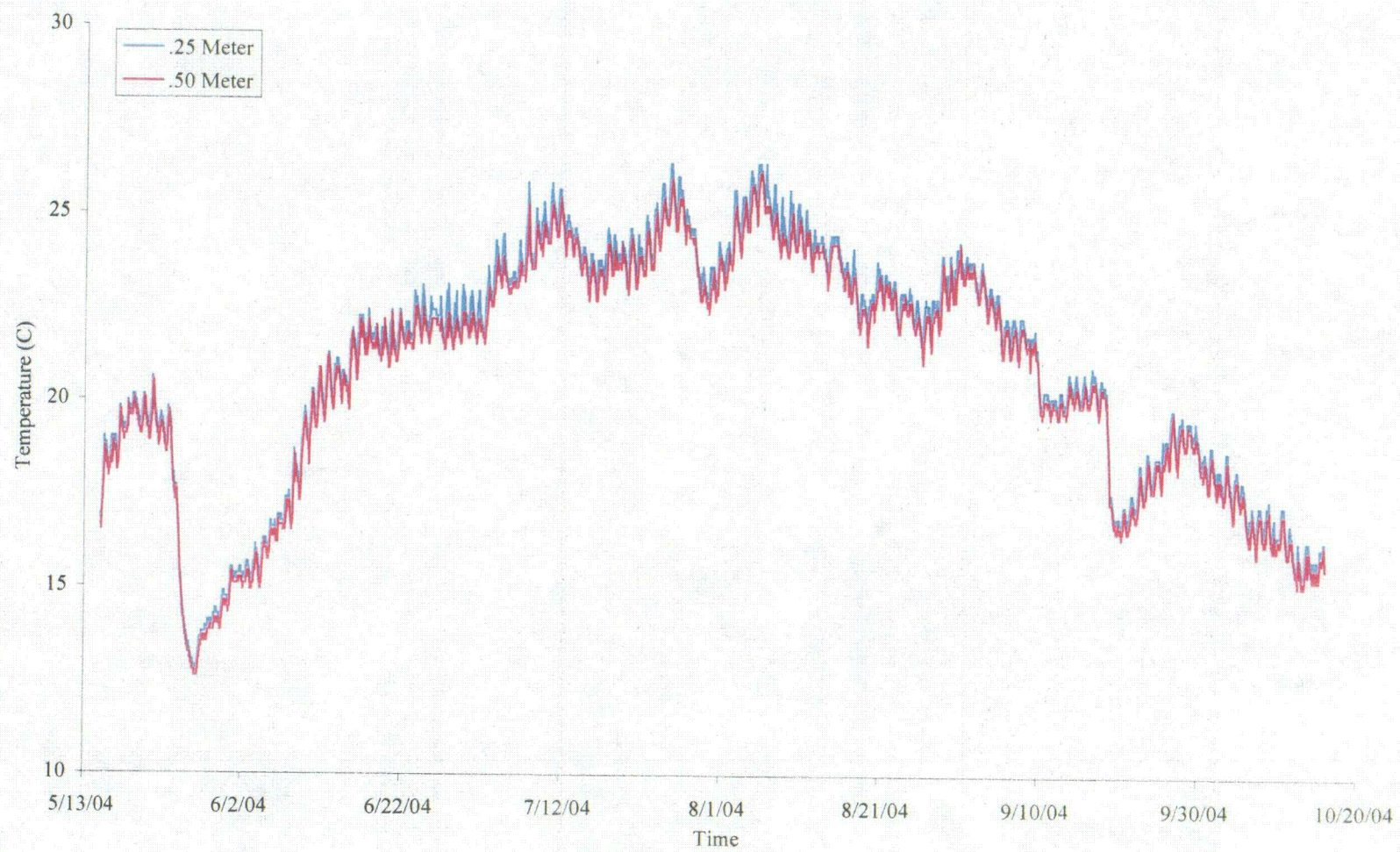


Figure 3. Temperature data from Station S2-2 downstream of Vernon Dam during summer permit conditions.

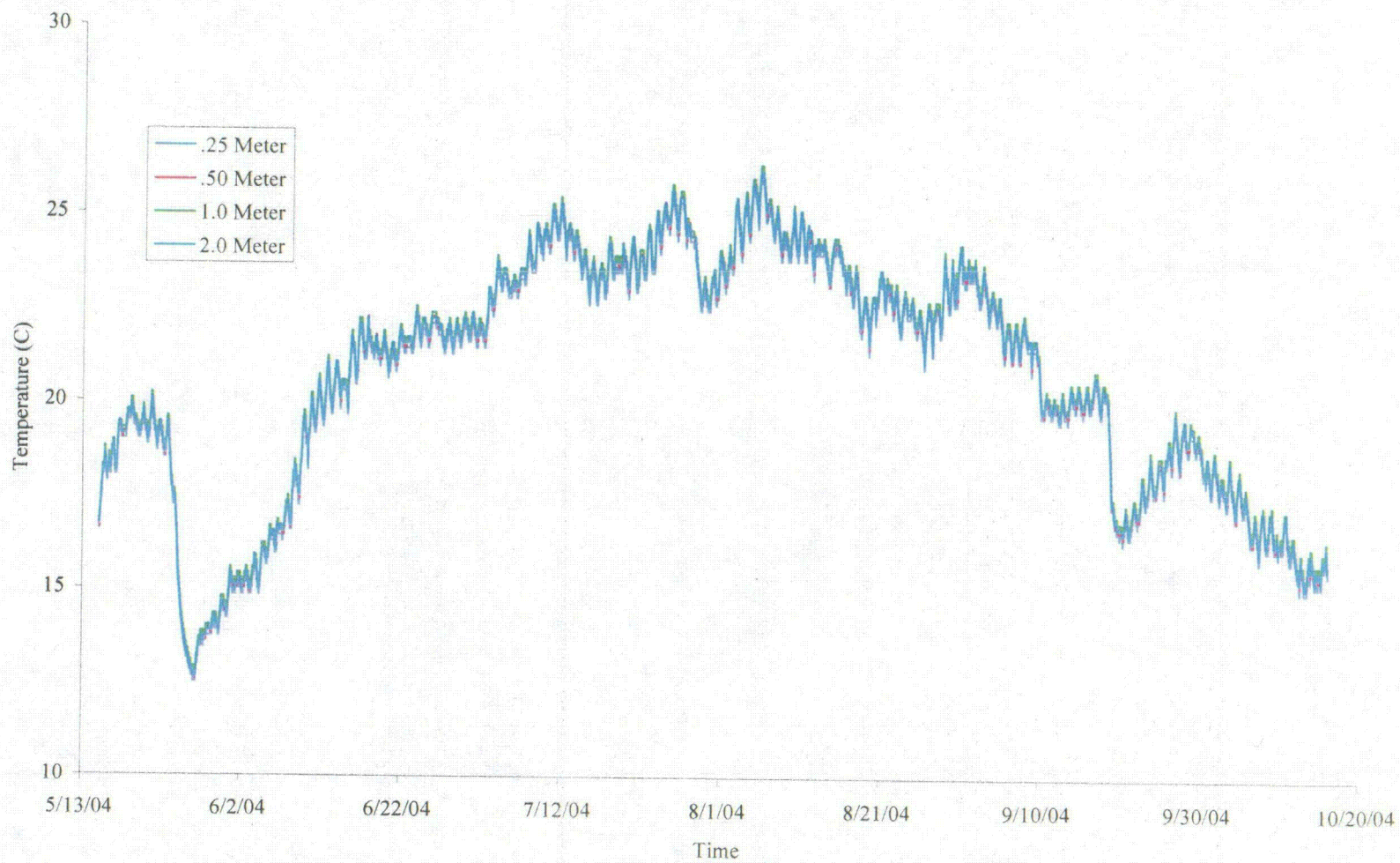


Figure 4. Temperature data from Station S3-1 downstream of Vernon Dam during summer permit conditions.



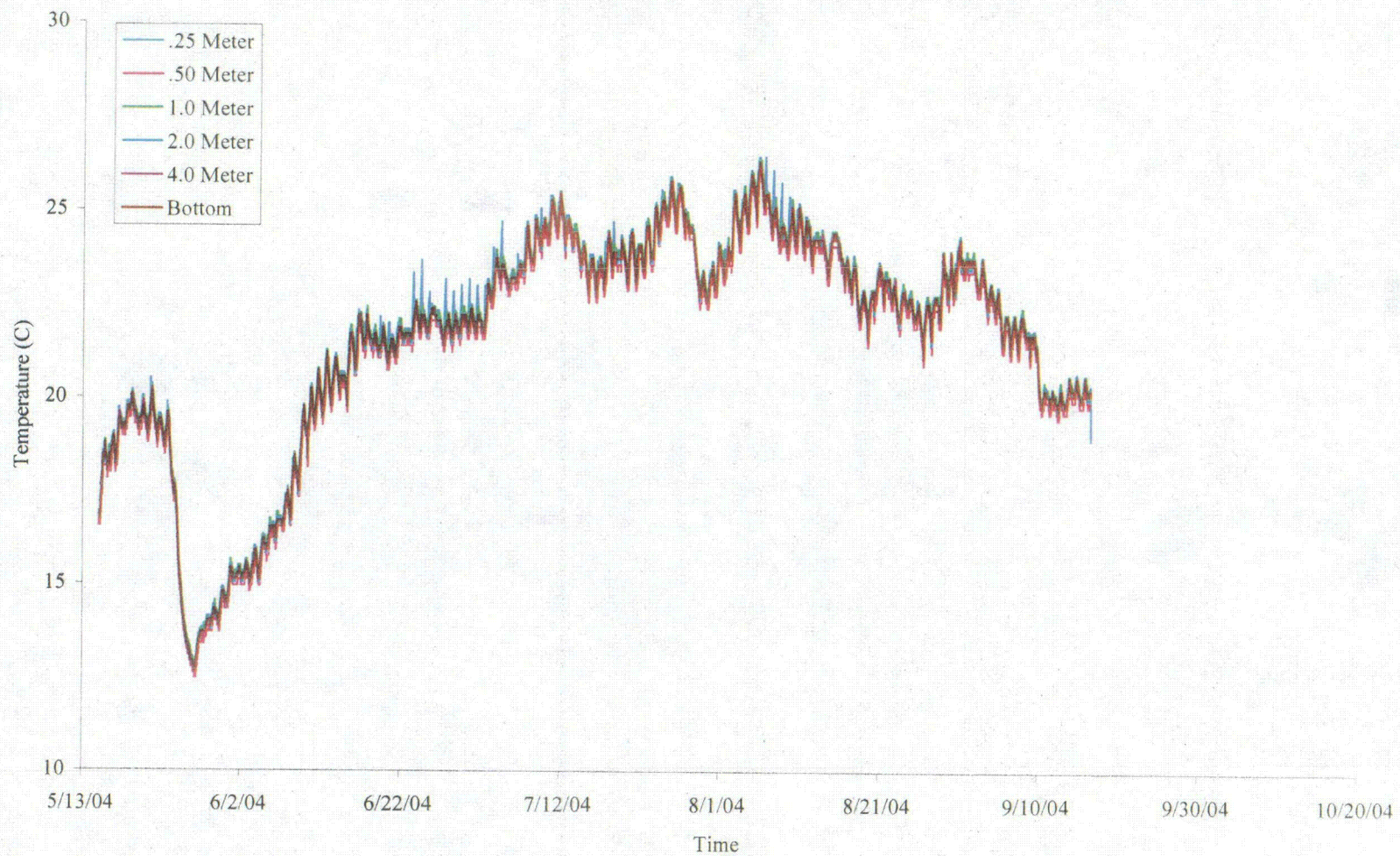


Figure 5. Temperature data from Station S3-3 downstream of Vernon Dam during summer permit conditions.

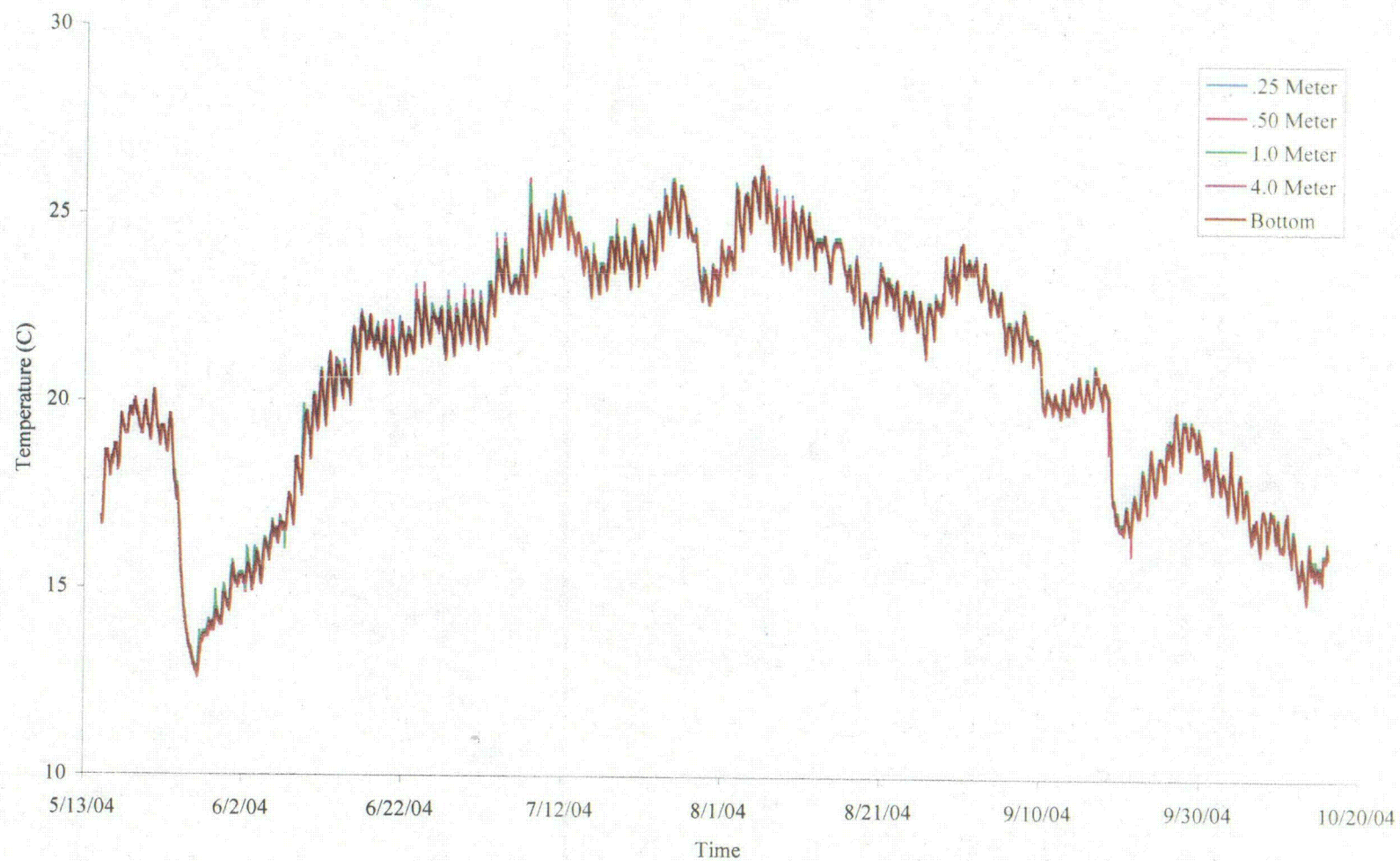
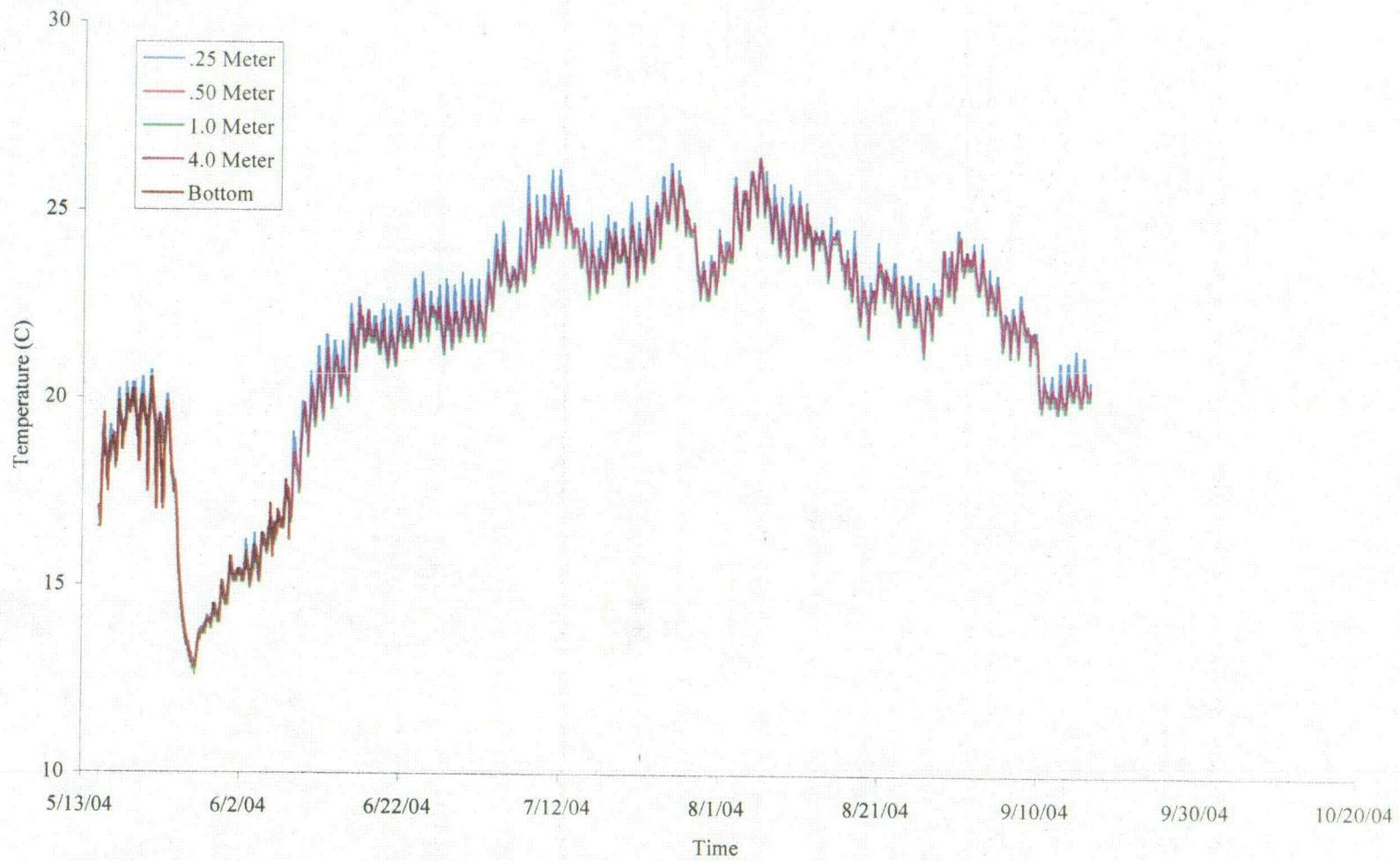


Fig 6. Temperature data from Station S4-1 downstream of Vernon Dam during summer permit conditions.





7. Temperature data from Station S4-2 downstream of Vernon Dam during summer permit conditions.

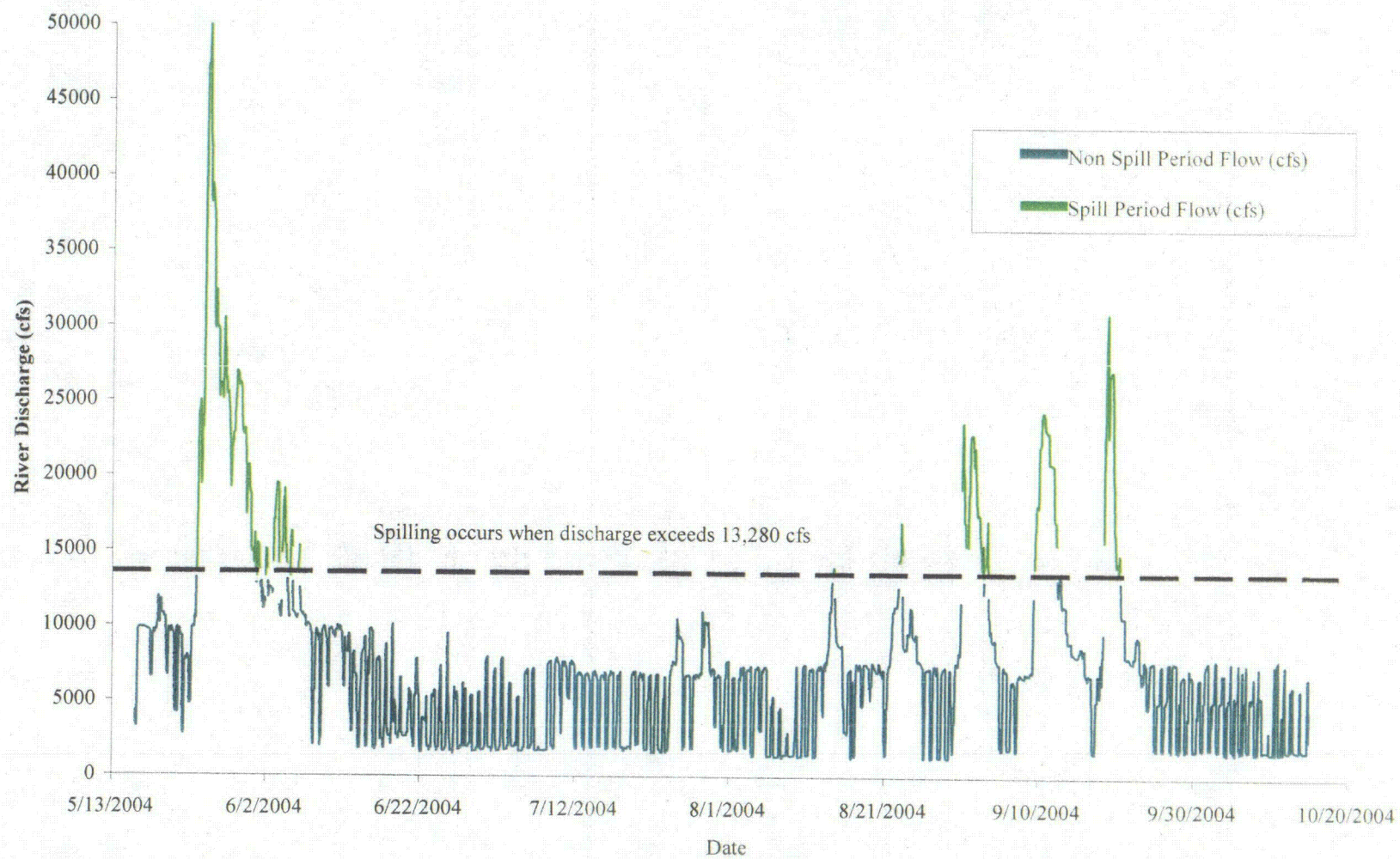


Figure 8. Connecticut River discharge (cfs) during the summer permit period of 2004.



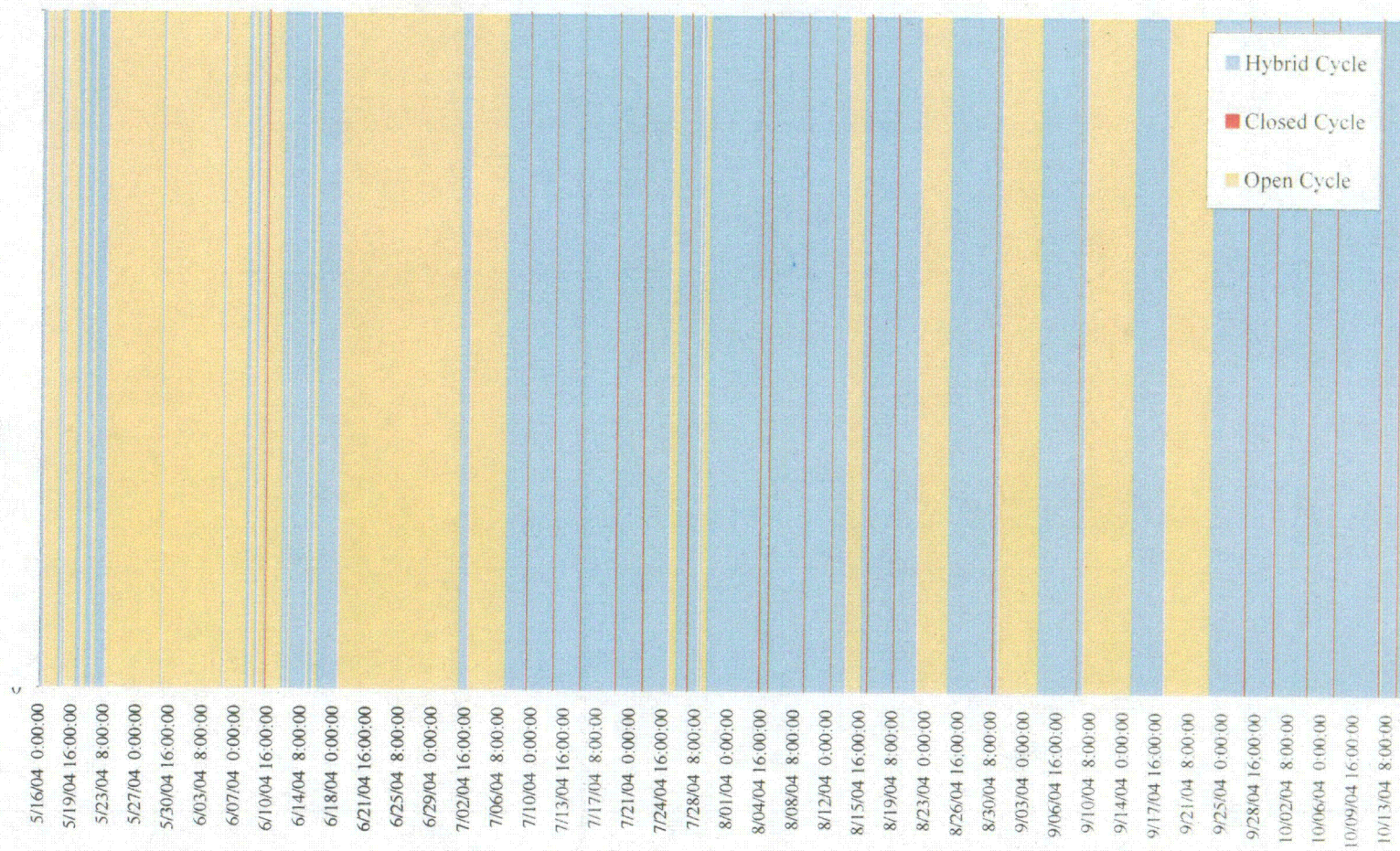


Figure 9. Summer permit period operations modes at Entergy Vermont Yankee during 2004.



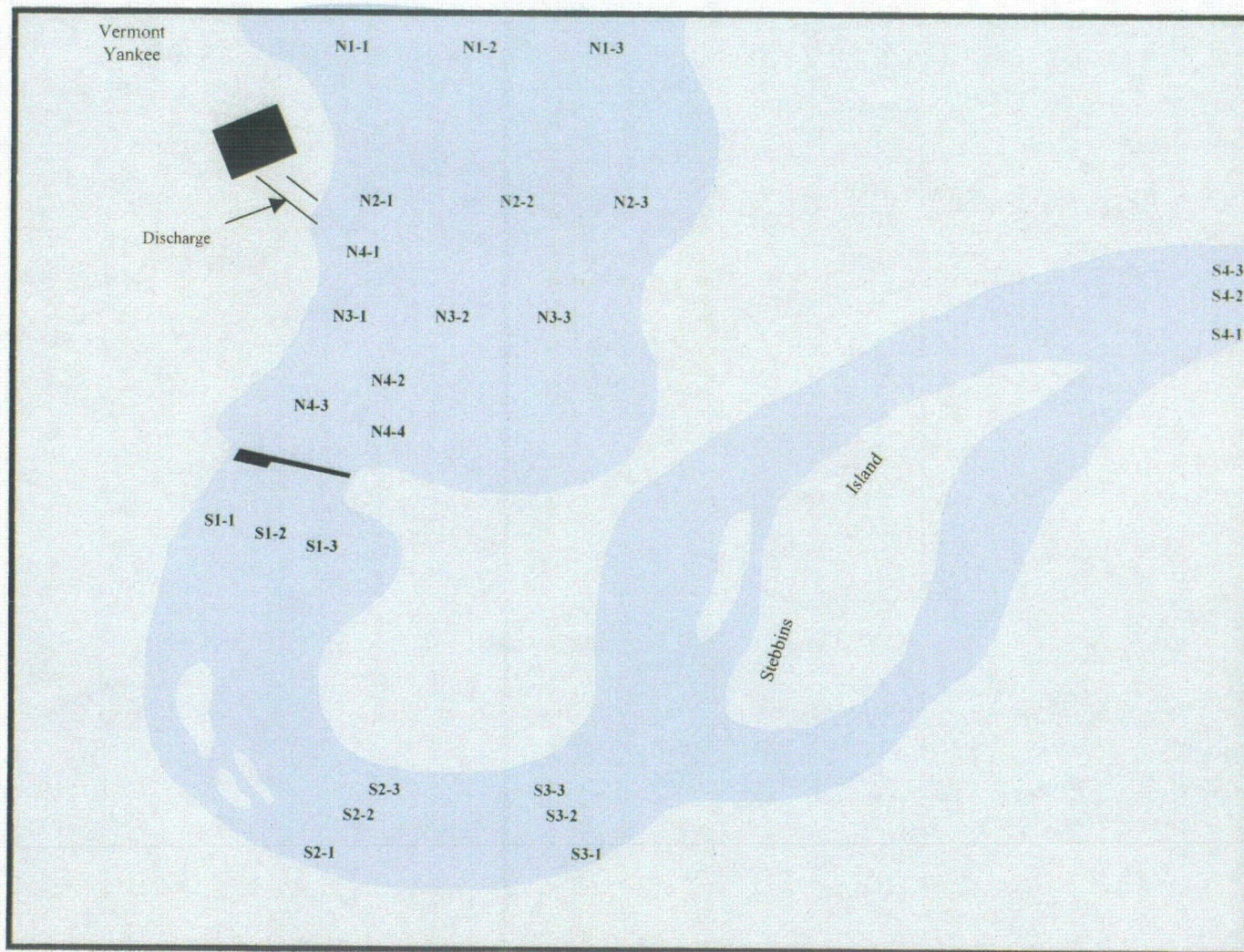
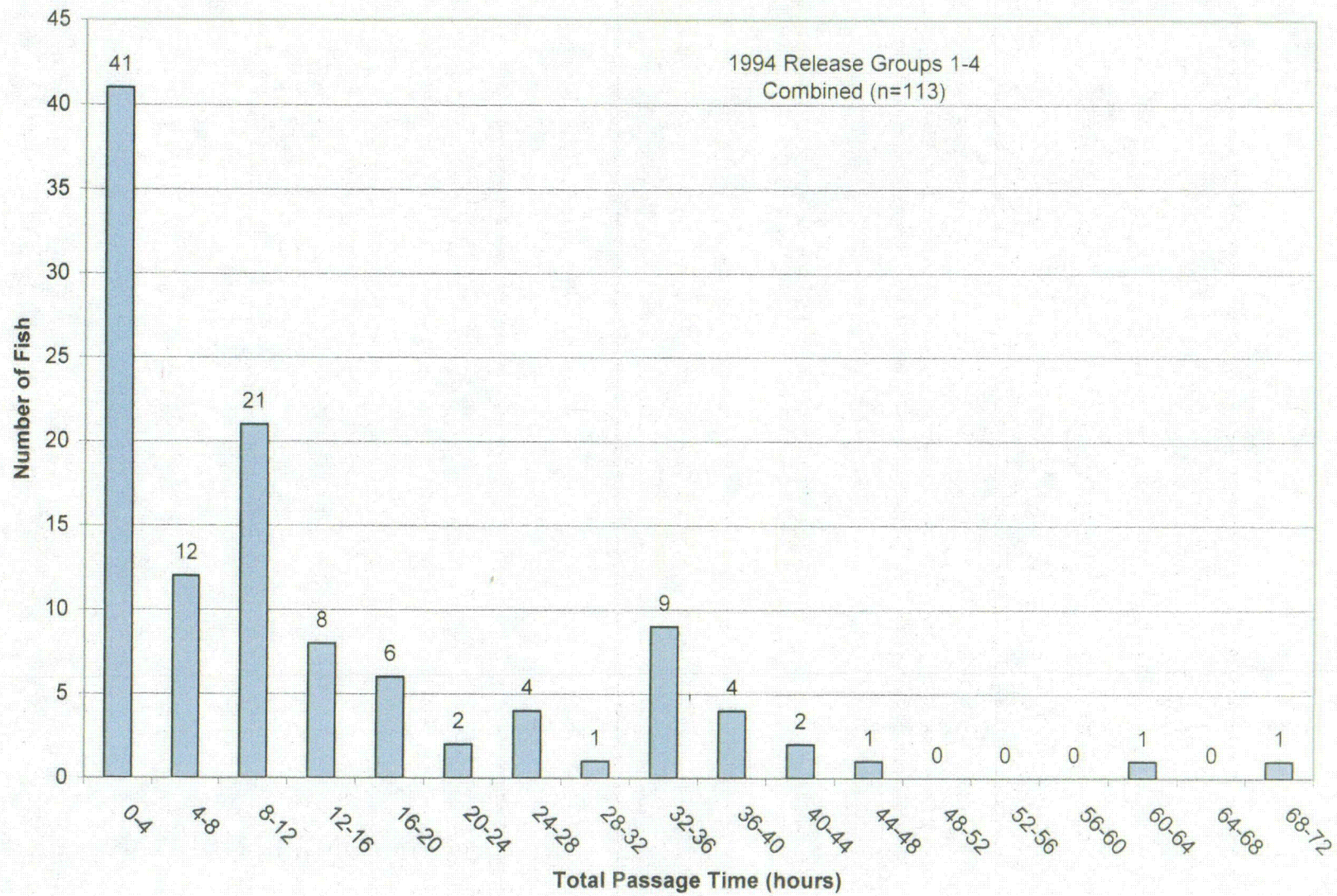


Figure 10. Station placement for the *in situ* assessment of water temperatures in Lower Vernon Pool and in the Vernon Dam tailrace areas of the Connecticut River during 13 January 2004 through 22 December 2004.



Figure 11. Atlantic Salmon Smolt Passage Rates through Vernon Dam, 14-27 May 1994.





**Figure 12. Atlantic salmon smolt passage rates through Vernon Dam, 1994, 1995 and 1996.**

