FINAL REPORT

DELAWARE RIVER TAILWATERS MONITORING,

FLEXIBLE FLOW MANAGEMENT PROGRAM,

OCT. 1, 2007- May 31, 2011

New York State Department of Environmental Conservation
Albany, NY 1223

Contributors:
Norman D. McBride
Jim Daley
Bob Anygal
Dan Zielinski

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EXECUTIVE SUMMARY

Overall, the FFMP releases program was effective in maintaining flow and temperature targets in the East Branch, West Branch, and Neversink River tailwater reaches. No thermal stress days were recorded for the East Branch or the West Branch and only 11 (2 in 2008 and 9 in 2010) in the Neversink River. FFMP summer base flows to the West Branch were inadequate in maintaining desirable summer water temperatures in the upper Delaware River but this was also true of all earlier releases programs. Thermal stress days on the Delaware River for the summers of 2008 through 2010 ranged from 0 to 25 at Lordville (RM 321) and 4 to 58 at Callicoon (RM 303). Complaints that FFMP worsened summer water temperatures in the Delaware River are unfounded.

Trout populations were unaffected by FFMP since it takes six years for the ages 1-5 year classes of trout to fully reflect the releases program being evaluated. It is recommended that future trout population studies not be a part of any short term releases program monitoring requirements.

The FFMP releases program was not without problems. The spring of 2008 “bouncing” or “yo-yoing” of release rates over a short time period was eliminated as procedures were effectively implemented to avoid automatic adjustments of release rates based only on the storage thresholds incorporated into the rule curves for FFMP. Although thermal banks were absent when FFMP was implemented, public pressure during a 2008 heat wave resulted in a thermal release and development of a thermal bank. Angler groups remain unhappy with the

small size (1,340 cfs) of the bank and restrictions on its use. The last unresolved issue remains the large and rapid reduction in release rates from an extended period of high flow to the base release, usually in September or October, when a major rain event is forecasted. As a result, there is widespread and rapid dewatering of the stream channel, primarily to the West Branch and Delaware River, which causes stranding and mortality of aquatic invertebrates and forces fingerling and yearling trout from the streambank edges to deeper water where they are subject to predation by larger trout. This is a major issue that needs to be addressed.

Frequent and large summer spill mitigation releases, particularly to the West Branch, could result in premature depletion of the coldwater (hypolimnion) volume in Cannonsville Reservoir. Such depletion in conjunction with a late August to September heat wave could result in a major and potentially catastrophic fish kill to the West Branch and Cannonsville Reservoir trout populations. Consideration should be given to reducing the frequency and size of summer spill mitigation releases to the West Branch. Furthermore, given the potentially high demands placed on a limited quantity of cold water and the importance of this resource to both reservoir and tailwater fisheries, completion of a rigorous quantitative assessment of the risk of a late summer fish kill due to depletion of the Cannonsville Reservoir hypolimnion should be seriously considered in the development of any future releases program.

INTRODUCTION

The tailwater portions of the West Branch Delaware River (West Branch), East Branch Delaware River (East Branch), Neversink River, and upper reaches of the mainstream Delaware River comprise one of the best wild trout fisheries in New York. Stream flows on these rivers are greatly influenced by releases from three New York City reservoirs: Cannonsville Reservoir on the West Branch, Peptacton Reservoir on the East Branch, and Neversink Reservoir on the Neversink River (Figure 1). These water supply reservoirs were constructed to provide water to New York City.

The volume and timing of releases from these reservoirs were stipulated in the U.S. Supreme Court decrees of 1931 and 1954. Modern reservoir release regulations for the Delaware tailwaters have evolved since 1976, when the New York legislature created Article 15, Title 8 of the New York State Environmental Conservation Law. Regulations (Part 671 of 6NYCRR) were adopted pursuant to the legislation, and the New York regulations were subsequently incorporated into Delaware River Basin statute (DRBC Docket D-77-20-CP). Modifications to reservoir operations must have the unanimous consent of all parties to the Supreme Court decree. These parties are the states of Delaware, New Jersey, New York, Pennsylvania, and New York City. The releases program currently in effect is called the Flexible Flow Management Program (FFMP).

The FFMP for the upper Delaware River Tailwaters was implemented October 1, 2007, and was scheduled to run through May 31, 2011, a period of 3.7 years. According to the Decree Parties agreement establishing this program, FFMP was designed to provide safe and reliable

supplies of water essential to serve the needs of over 17 million people who depend on water from the City's Cannonsville, Pepacton and Neversink Reservoirs (City Delaware Basin Reservoirs) and their tailwaters, and the Delaware River; to manage discharges from the City Delaware Basin Reservoirs; to provide flows to help control temperatures in the tailwaters to help sustain cold water fisheries; to assist in mitigating the impacts of flooding; and to provide flows in the main stem and the Delaware Bay to help protect ecological health, support withdrawal and non-withdrawal uses, and repel salinity.

As part of the FFMP agreement, the New York State Department of Environmental Conservation (DEC) monitored the releases program to evaluate its effectiveness in protecting the coldwater ecosystem below the reservoirs. This report summarizes the impact of FFMP on summer water temperatures and trout populations.

FLEXIBLE FLOW MANAGEMENT PROGRAM

FFMP releases were determined by fixed release schedules that depend on season, reservoir storage level, and the amount of water made available from the New York City diversion for the program during a given year. Release schedules were developed with 0, 10, 20, and 35 MGD of water made available. The 35 MGD release schedule (Table 1) was the standard during this 3.7 year period of FFMP from October 1, 2007 through May 31, 2011, with the L2 storage level releases considered the normal.The L3, L4, and L5 releases occur when the reservoir system is in drought watch, warning, and emergency, respectively. Drought watch occurs when the combined capacity of the reservoir system declines to 40% capacity. The Ll-a, Ll-b, and Ll-c releases, which can vary depending on time of year, generally occurs when the combined capacity of the three reservoirs is at 95%, 90%, and under 90% respectively. See the

Delaware River Master home web page (http://water.usgs.gov/osw/odrm/index.html) for the operational details concerning FFMP.

The 35 MGD table was modified in 2008 and again in 2009. The 2008 modification split the L2 release schedule for May and September into two periods for all three reservoirs (Table 2). The change was made to benefit trout anglers for the late May and early September period. The 2009 modifications were limited to the West Branch with no changes to the East Branch and Neversink River (Table 3). Cannonsville Reservoir releases were only changed for the June 1 through August 31 summer period. The Ll-c release was increased from 275 cfs to 325 cfs and the L2 storage zone was split into an L2- High and L2-Low storage zones. The summer release was increased from 260 cfs to 325 cfs in the L2-High storage zone and to 300 cfs in the L2-Low storage zone.

Spill mitigation releases, which are intended to reduce the intensity of peak spills, were incorporated into FFMP. The spill mitigation program uses reduced storage level targets for Cannonsville, Pepacton, and Neversink Reservoirs during the "drawdown" period of July 1 through May 1. For purposes of determining whether spill mitigation releases are made, 50% of the measured snowpack in the reservoir watershed are included in the storage calculation. There are two stages of enhanced spill mitigation release where maximum capacity releases are made to reduce reservoir storage to 95% and smaller enhanced releases are made to reduce reservoir storage to 90%. The storage targets are ramped up and down to ease the transition from retaining water for public water supply to promoting spill mitigation. Enhanced releases are intended to be made well in advance of a storm event since the capacity of the release works on these reservoirs

is relatively small compared to flood control structures. Enhanced releases are discontinued when downstream flooding is forecasted to prevent an increase in downstream flood stages.

A primary objective of the FFMP was to eliminate "banks" of water that were relied upon in earlier lower agreements to meet temperature and/or habitat flow targets. These banks proved to be problematic for several reasons. First, meeting temperature and/or flow targets involves combining weather forecasts, current stream conditions, models and experience to predict how much water needs to be released to maintain flow or temperature targets days in advance. This has proven to be very difficult and requires staff to constantly monitor stream conditions. Second, various interested parties have different views on when and how water should be released from a bank, often resulting in pressure on DEC to release water when circumstances may not warrant it. Finally, water in the banks often went unused at the end of the season and therefore did not provide any habitat benefits to the system. Although a thermal bank was absent when FFMP was implemented, public pressure during a 2008 heat wave resulted in a thermal release and development of a 1,340 cfs thermal bank.

THE DELAWARE TAILWATERS

Water releases from three large New York City water supply reservoirs in the Delaware River basin are critical for maintaining trout populations in approximately 70 miles of downstream tailwaters (Figure 1). Releases from the Neversink Reservoir are intended to maintain trout conditions in 16 miles of Neversink River downstream to Bridgeville. Pepacton Reservoir releases to the East Branch are designed to provide trout habitat for 17 miles

downstream to the confluence with the Beaver Kill. From Cannonsville Reservoir on the West Branch, releases are intended to produce trout conditions for the entire 18 miles downstream to Hancock as well as in an additional 18 miles of the Delaware River between Hancock and Hankins. Each of these four rivers are described in greater detail below.

East Branch Delaware River

The East Branch downstream of Pepacton Reservoir flows for 32.1 miles before merging with the West Branch to form the Delaware River (Figure 1). The tailwater reach extends 17 miles downriver from the dam to the confluence with the Beaver Kill. The East branch downstream of the Beaver Kill also supports a wild trout fishery but this reach normally does not receive any thermal benefits from the cold water releases at the Pepacton reservoir dam. The tailwater reach will be referred to as the upper East Branch in this report.

The upper East Branch is a medium size river with an average daily flow of 387 cfs for the 1955-2009 monitoring period at the USGS Harvard gage (USGS website). Stream flows and summer water temperatures in the river are largely dependent on water releases from Pepacton Reservoir. Prior to the 2007-2011 FFMP releases protocols, base releases to the upper East Branch typically ranged from 45 to 95 cfs depending on time of year.

Summer cold water releases are intended to make the upper East Branch suitable for trout throughout its 17.0 mile length. However, the lowermost three miles supports marginal trout habitat as evidenced by the sparse wild trout population. Brown trout are the dominant trout species with brook and rainbow trout present throughout the upper East Branch. The wild trout population in portions of the upper East Branch is supplemented with the stocking of 1,500 yearling and 800 two year old brown trout annually which is equivalent to about 67 yearlings and

7 older fish per acre in the stocked reach. Yearling trout are stocked in the 5.1 mile reach from the Corbett Bridge downstream to 1.5 miles below the Shinhopple Bridge. The two year old fish are stocked in the 9.1 mile reach from Downsville downstream to 1.5 miles below the Shinhopple Bridge. Yearling trout are stocked in the 5.1 mile reach from the Corbett Bridge downstream to 1.5 mile below the Shinhopple Bridge. The two year fish are stocked in the 9.0 mile reach from Downsville downstream to 5.1 mile below the Shinhopple Bridge.

Trout population studies were conducted at three standardized study sites from 1993 through 1995 and again in 1996 and 2002 at one site. Trout density and biomass in the river from 1993 through 1995 average 93 trout/acre (range was 2 to 311 trout/acre) and 17.0 lbs/acre (range was 1.4 to 44.7 lbs/acre). Trout per mile averaged 613 yearlings and older fish (range was 31 to 3,390 trout/mi) and 44 legal (≥ 12 in) fish/mile (range was 5 to 170 trout/mi). One site from this previous study plus three new sites were sampled annually from 2004 through 2007. The trout density and biomass from this study averaged 77 trout/acre (range was 5 to 173 trout/acre) and 37.6 lbs/acre (range was 0.4 to 105.5 lbs/acre). Trout per mile averaged 962 yearling and older fish (range was 50 to 2,159 trout/mi) and 192 legal (≥ 12 in) fish/mi (range was 0 to 583 legal trout/mi).

The East Branch trout fishery is managed under a 12 inch minimum size limit and a two fish daily creel limit throughout its entire length with the trout season running from April 1 through October 15. From Shinhopple downstream, additional fishing opportunity is provided by allowing catch and release fishing only from October 16 through November 30. Upstream of Shinhopple to the dam, all fishing is prohibited once the regular trout season closes to protect spawning trout. The last angler survey on the East Branch was conducted in 2006. In that survey,

fishing pressure on the upper East Branch totaled15,905 hours or 7,490 trips (McBride et al 2008). This effort averaged 67 hours/acre, 32 trips/acre, or 441 trips/mile. However, 42% of the total effort occurred in the 4.1 mile downstream to Corbett reach and another 33% on the 5.7 Shinhopple to Harvard reach. Anglers averaged 0.28 trout/hour in the upper East Branch with brown trout the dominant trout caught and creeled.

Angler diary cooperators from 2002 through 2007 had average annual trout catch rates ranging from 0.59 to 1.21 fish/h and 0.22 to 0.72 legal (≥ 12 in) fish/h. The six year average catch rate was 0.92 trout/h and 0.50 legal trout/h. The percentage of trout caught that were legal size, 15 in plus, and 20 inplus averaged 54% (range was 36 to 60%), 27% (range was 9 to 35%) and 3% (range was 1 to 5%), respectively. Wild brown trout dominated the catch (69%) followed by hatchery brown trout (28%), brook trout (3%), and rainbow trout (1%).

West Branch Delaware River

The West Branch downstream of Cannonsville Reservoir flows for 17.7 miles before merging with the East Branch to form the Delaware River (Figure 1). The upper 10.2 miles is located entirely in New York while the lower 7.5 miles of river forms the state boundary between New York and Pennsylvania. It is a large river with an average daily flow of 861 cfs for the 1964-2009 monitoring period at the USGS Hale Eddy gage (USGS website). Stream flows and summer water temperatures in the river are largely dependent on water releases from Cannonsville Reservoir. Prior to the 2007-2011 FFMP releases, base releases generally ranged from 33 to 325 cfs depending on the time of year. River Master directed releases, which NYC typically makes to the West Branch, can exceed 1400 cfs and are frequent during a dry summer and fall.

Summer cold water releases make the West Branch suitable for trout throughout its 17.7 mile length. Trout populations consist primarily of brown trout with rainbow trout also found throughout the river. Brook trout are rare with rainbow trout more common in the border water reach. The river supports a wild trout fishery that was last stocked in 1994. However, a small number of hatchery brown trout from the Oquaga Creek stocking migrate downstream into the Deposit area of the West Branch.

Trout population studies have been conducted most years since 1993 at four standardized study sites. From 1993 through 2006, trout density and biomass in the river averaged 59 fish/acre (range was 7 to 191 fish/acre) and 41.7 lbs/acre (range was 4.7 to 166.1 lbs/acre). Yearling and older trout per mile averaged 1,163 fish (range was 100 to 3,906 trout/mile) with 504 legal (≥12 in) fish/mile (range was 42 to 2,269 trout/mile). Trout are generally more abundant in the upper reaches. The two study sites closest to the dam have more trout (48 to 66 lbs/acre) than the two downriver study sites (26 to 28 lbs/acre).

The trout fishery is managed under special regulations, either catch and release with artificial lures only (1 reach totaling 2.0 mile) or a 12 inch minimum size trout with a two fish daily creel limit (2 reaches totaling 14.3 miles). The New York trout season opens April 1 and closes October 15. On the reach forming the state boundary between New York and Pennsylvania, the trout season opens the first Saturday after April 11 and closes October 15. On the border water reach, catch and release fishing with artificial only is allowed for the entire period outside the regular trout season. For the reach entirely in New York, all fishing is prohibited once the trout season closes in order to protect spawning trout.

Although the last angler survey on the West Branch was conducted in 2006, the data should not be considered representative due to the adverse impact of the June flood event that year. The last representative creel survey occurred in 1999. During the 1999 creel survey, fishing pressure on the West Branch totaled 63,972 hours or 15,123 trips for an average of 140 hours/acre, 33 trips/acre, or 928 trips/mile (McBride 2003). However angler effort is not uniformly distributed. In the upper 4.4 mile reach, fishing pressure averaged 238 hours/acre compared to only 110 hours/acre for the lower 11.9 miles of river. New York City prohibits fishing in the 1.4 mile reach between the dam and the weir at Stilesville. Anglers in 1999 averaged 0.66 trout/hour with catch rates averaging 0.82 trout/hour in the upper 4.4 miles and 0.51 trout/hour in the lower 11.9 miles of river. The creel rate was a low 0.03 fish/hour. The creeled catch was dominated by brown trout with anglers creeling an estimated 1,601 wild brown trout, 128 hatchery brown trout, 55 reservoir brown trout, and 68 rainbow trout (McBride 2003).

Angler diary cooperators from 2002 through 2007 had average annual trout catch rates ranging from 0.38 to 0.79 fish/h and 0.20 to 0.55 legal (≥ 12 in) fish/h. The six year average catch rate was 0.69 trout/h and 0.45 legal trout/h. The percentage of trout caught that were legal size, 15 in. plus, and 20 in. plus averaged 66% (range was 52 to 77%), 37% (range was 19 to 48%), and 5% (range was 1-8%), respectively. Wild brown trout dominated the catch (90%) followed by rainbow trout (9%), brook trout (≤1%) and hatchery brown trout (≤1%).

Delaware River

The Delaware River, below the confluence of the East and West Branches flows for 321 miles before entering the Atlantic Ocean and forms the state boundary between New York and

Pennsylvania for the uppermost 74 miles. This very large river has an average annual daily flow of 2,921 cfs for the 1975-2009 monitoring period at the USGS Callicoon gage (USGS website). Summer water temperatures are strongly influenced by the warm East Branch and the volume of cold water being released to the West Branch. At the confluence, the East Branch side of the river can be up to 25°F warmer than the West Branch side of the river. In general, base releases from Cannonsville Reservoir are insufficient in providing significant cold water benefits to the Delaware River. Large River Master directed releases or thermal releases are required to provide these cold water benefits. Originally, Callicoon was considered the downstream end of the tailwaters but now it is Hankins which is 18 miles below the confluence of the East and West Branches (Figure 1). However the DEC and Pennsylvania Fish and Boat Commission white paper defines Lordville (Figure 1) as the lower boundary of good trout water under its recommended release program.

The wild trout population is dominated by rainbow trout but brown trout are common. Due to the Delaware River's large size, fish sampling has been ineffective. The limited sampling undertaken suggests that trout abundance averages 5 to 10 lbs/acre (Sanford 1992: McBride 1995) with warm water fishes such as smallmouth bass and walleye common. The river also supports an American shad fishery in late spring. In recent years, striped bass have been appearing in the upper river reaches.

The trout fishery is managed under a 14 inch size limit and a one fish daily limit throughout the river. The trout season runs from the first Saturday after April 11 through October 15. Catch and release fishing for trout outside the regular trout season is permitted throughout the river.

No creel survey of the entire trout reach has been conducted on the Delaware River; however, a 2.3 mile reach by Lordville (Figure 1) was last censussed in 1999. Fishing pressure on this reach totaled 3,722 hours or 1,149 trips (McBride 2003) which averaged 37 hours/acre, 11 trips/acre, or 500 trips/mile. These anglers averaged 0.32 trout/hour and reportedly creeled no trout (McBride 2003).

Anglers diary cooperators from 2002 through 2007 had average annual trout catch rates ranging from 0.25 to 0.65 fish/h and 0.19 to 0.47 legal (≥ 14 in) fish/h. The six year average catch rate was 0.48 trout/h and 0.31 legal trout/h. The percentage of trout caught that were legal size, 18 in. plus, and 20 in plus averaged 64% (range was 51 to 77%), 19% (range was 11 to 24%) and 4% (range was 2 to 8%). Rainbow trout dominated the catch (61%) followed by wild brown trout (38%), brook trout (≤1%), and hatchery brown trout (≤1%).

Neversink River

The Neversink River downstream of Neversink Reservoir flows for 40.3 miles before entering the Delaware River at Port Jervis (Figure 1). The tailwater reach extends from the dam downstream 16.3 miles to Bridgeville. Although the trout fishery extends another 14 miles downriver, this reach receives essentially no thermal benefits from the cold water releases at the dam.

It is a small river with an average daily flow of 251 cfs for the 1993-2009 monitoring period at the USGS Bridgeville gage (USGS website). Stream flows and summer water temperatures in the tailwater reach are largely dependent on water releases from Neversink Reservoir. Prior to the 2007-2011 FFMP releases protocol, base releases to the river ranged from 25 to 53 cfs depending on time of year.

The tailwater reach supports a wild trout population dominated by brown trout. Brook trout are occasionally found while wild rainbow trout are absent. The wild trout population is supplemented with the annual stocking of 6,500 yearling brown trout at an average rate of 116 fish/acre. In addition, a private group stocks several thousand 13 to 17 inch and larger brook, brown and rainbow trout annually at one stocking location in the area of Avon Lodge (Angyal 2004).

The tailwater trout fishery is managed under a 9 inch minimum size limit and five fish daily creel limit throughout its 16.3 mile length. The trout season opens April 1 and closes October 15.

Trout population studies were conducted at three standardized site 8 to 9 times from 1992 through 2006. Trout density and biomass in the tailwater reach averaged 83 trout/acre (range was 4 to 405 trout/acre) and 40.3 lbs/acre (range was 0.7 to 110.2 lbs/acre). Trout per mile average 181 yearling and older fish/mile (range was 22 to 402 fish/mile) and 121 legal (≥9 in) fish/mile (range was 0 to 339 legal fish/mile). The number of 12 inch and larger trout average 39 fish/mile (range was 0 to 95 fish/mi).

The last angler survey on the Neversink River tailwater was conducted in 2006. In that survey, fishing pressure totaled 11,328 hours or 4,356 trips on the tailwater reach (McBride et al 2008). Fishing effort averaged 135 hours/acre, 52 trips/acre, or 267 trips/mile. However, angler effort was not evenly distributed. Fishing pressure was lowest on the reach closest to the dam (26 hours/acre) and highest in the Avon Lodge reach at 291 hour/acre. Anglers in 1999 averaged 0.67 trout/hour (range was 0.31 to 0.78 trout/hour) and 0.57 legal (≥9 in) trout/hour (range was 0.24 to 0.64 fish/hour). Catch rates of 0.31 trout/hour were lowest near the

dam compared to the average of 0.70 trout/hour downstream between Woodbourne and Bridgeville.

METHODS

Flow Measurements

Flow immediately below each reservoir (release or release plus spill) were measured and recorded at USGS gages at Neversink, Downsville, and Stilesville and further downstream at the habitat references sites at Bridgeville, Harvard, and Hale Eddy.

Temperature Monitoring

Thermal data were obtained from eight permanent USGS gages and 21 Onset Optic "Stow Away" thermographs installed and maintained by DEC staff on the upper East Branch, West Branch, Delaware River, and Neversink River. The thermographs have a resolution of 0.2°C and were set to record temperature hourly. Thermographs were placed in the deepest water that personnel could access. All thermographs were encased in a length of heavy pipe and chained to a stake or adjacent rock. Accuracy of the thermographs was checked against a hand held calibrated mercury thermometer. Ideally, thermographs were placed by June 1 and removed by September 30. However, placement and removal dates were dependent upon suitable flows. Placement in 2009 occurred after July 1 for the West Branch, East Branch, and upper Delaware River because of unusually high flows in late May and June.

Data analysis involved selecting the highest of the 24 hour recordings as the daily maximum and the mean of the 24 hourly recordings as the daily average. Daily maxima and weekly averages are presented for the summer period and compared to existing regulatory criteria or biological standards developed from the fisheries literature (Elliot 2001)

Thermal stress day observations were used because they permit comparison with water temperature data by site within the same river between years. A thermal stress day occurs when the maximum water temperature equals or exceeds 75°F and/or the water temperature equals or exceeds 72°F for an entire 24 hour period (Sheppard 1983). Although useful for comparative purposes, the thermal stress day criteria defined by Sheppard (1983) was never intended to be used as targets to define favorable temperature conditions for trout (Hulbert 1987).

Trout Population Sampling

The four upper East Branch and four West Branch study sites were sampled for trout with a 14 foot flat bottom aluminum boat equipped with a 2500 W Honda generator in conjunction with a Smith-Root variable pulsator. AC current was rectified to DC with voltage typically set at 1061 volts. Anodes were of the umbrella type with four droppers per ring. The cathode was mounted off hull in front of the boat. The three Neversink River study sites were sampled with a 12 foot commercially manufactured (Smith-Root) electrofishing boat with a 5000 W generator and variable pulsator. With this boat, the aluminum hull was utilized as the cathode. Voltage was typically set at 883V.

Multiple electrofishing runs were made in pools with, against, perpendicular, and at angles to the current. All yearling and older trout were collected, measured for total length to the nearest mm, marked with a hole punch or caudal clip, and transferred to a fish holding cage until sampling was completed. Fish were then released in the pool where they were captured. Trout ≥305 mm (12 in) were weighed to the nearest 5 g. Scales were taken from at least 5 trout per centimeter group except for obvious hatchery or wild yearlings. Sampling was typically conducted from late June through August.

All population estimates were calculated using the Chapman version of the Petersen mark-recapture formula (Ricker 1975):

$$N = \frac{(M+1)(C+1)}{R+1}$$

Where N = estimated population
M= number of fish marked
C= number of fish examined for marks
R= number of recaptures (marked) in sample

Confidence intervals were calculated with the formula:

$$[(M+1)(C+1)(M-R)(C-R)]/[(R+1)(R+1)(R+2)]$$

to compute variance. The 95% confidence limits for the estimate is plus or minus two times the square root of this variance.

Trout data from the marking and recapture effort were grouped into 1.0 inch size groups and the percentage of fish in each group determined from the total number of fish collected. This percentage was then multiplied by the estimated total trout population to estimate the number of trout for each inch group. The number of wild brown trout, hatchery brown trout, rainbow trout, and brook trout were then calculated based on their capture percentages within each inch group. For each trout <12 inches, weight was determined from the metric length equation ($W(lbs) = L(mm)^3/45454545$) in the New York stocking guidelines (Engstrom-Heg 1990). This equation assumes a condition factor of 1.0. Mean weight for each inch group was then calculated, multiplied by the estimated number in that group, and totaled to determine biomass. The estimated population size and biomass was then divided by the study reach area to determine trout density and pounds per acre.

RESULTS

WEST BRANCH

Air Temperature

The Deposit weather station in 2008, 2009 and 2010 recorded a maximum air temperature of 94°F, 90°F, and 96°F, respectively. Temperatures 90°F or higher occurred on three days in 2008, once in 2009, and seven days in 2010. The summer (June 1- Sept. 15) of 2010 was the warmest of the three years that FFMP was in effect. There were 37 days that summer when the air temperature was 85°F or higher compared to 19 days in 2008 and 11 days in 2009. The summer of 2009 was unusually cool with 49 days when the maximum air temperature was 75°F or lower compared to 26 days in 2008 and 28 days in 2010.

Peak Flows

Peak flows at the USGS gage in Hale Eddy in 2008, 2009, and 2010 were 11,400, 8,200 and 9,150 cfs, respectively. These peak flows were low compared to the peak flow of 17,500, 21,500, and 43,400 cfs recorded in 2004, 2005 and 2006, respectively. The 2004, 2005, and 2006 peak flow events ranked fourth, second, and first since Cannonsville Reservoir became operational in 1963.

Spill Mitigation Releases

Spill mitigation releases, ranging from 110 to 2,116 cfs, were made to the West Branch on 522 days between June 1, 2009 and May 31, 2011 (Table 4). No such releases were made between June 1, 2008 and May 31, 2009. These releases were made most frequently during the winter and spring quarters. The high frequency of summer spill mitigation releases in 2009 reflected the wet summer and high reservoir levels that year.

Summer Water Temperatures

No thermal stress days were reported at any of the 10 West Branch temperature monitoring stations during the 2008-2010 monitoring period (Table 5). The maximum water temperature recorded was 73.8°F in 2008, 71.4°F in 2009, and 73.9°F in 2010. Typically, the warmest water temperature occurred in the lower reaches as was the case in 2008 and 2010. In 2009, however, the warmest water temperature was recorded at the monitoring station closest to the dam and was the result of summer spillage at the Cannonsville Dam. The spillway at the dam and the USGS Stilesville gage are located on the north side of the West Branch. The DEC Stilesville temperature monitoring station and coldwater release outfall are located on the south side of West Branch. The difference in the daily maximum water temperature for the two Stilesville monitoring stations ranged from 5.6 to 20.5°F from July 31 through August 14. The number of summer (June 1-Sept. 15) days that the West Branch daily maximum water temperature was 70°F or higher totaled 13 days in 2008, 2 days in 2009, and 3 days in 2010. The reduced number of days when the daily summer water temperature was 70°F or warmer compared to 2008 was due to higher summer releases: 260 cfs in 2008 and 325 cfs in 2010.

The longitudinal daily average summer water temperature profiles for the 2008-2010 monitoring period at Stilesville, Hale Eddy, and Hancock is illustrated in Figures 2. See Appendices 1, 2 and 3 for the minima, average, and maxima summer water temperature for each individual temperature monitoring station on the West Branch for the 2008-10 monitoring period. Summer (June 1- Sept. 15) daily average water temperatures were coolest at Stilesville and warmest at Hancock. At Stilesville in 2008, 2009, and 2010, the highest average summer water temperature recorded was 50.6°F, and 54.0°F, respectively. The highest summer daily

average water temperatures at Hale Eddy was 62.1°F in 2008, 60.7°F in2009, and 59.9°F in 2010. At Hancock in 2008, 2009, and 2010, the highest daily average summer water temperatures recorded was 68.1°F, 64.7°F, and 67.6°F, respectively.

During the summer of 2008 at Stilesville, the daily average water temperature was less than 50°F for all but two days. There were 69 days in 2009 and 28 days in 2010 when the daily average summer water temperature at Stilesville was 50°F or higher. The number of days at Hale Eddy where the daily average summer water temperature was above 60°F in 2008, 2009, and 2010 totaled 3, 3, and 0, respectively. At Hancock, the daily average summer water temperature in 2008, 2009, and 2010 was 65°F or higher on 23, 0, and 11 days, respectively.

Thermal Releases

Thermal releases were made to the West Branch on two occasions to alleviate thermal stress to trout in the Delaware River. During the summer of 2008 and 2010, thermal releases were made over a three day period each year. Thermal releases ranged from 274 to 657 cfs in 2008 and 514 to 524 cfs in 2010 (Table 4).

Trout Populations

The four standardized sites on the West Branch were sampled in 2009 and 2010. See Appendices 5 and 6 for the site specific trout catch and population estimates at the four West Branch study sites in 2009 and 2010. In 2009, trout density ranged from 19 to 187 trout/acre compared to 30 to 193 trout/acre in 2010 (Table 6). Trout biomass in 2009 ranged from 23.7 to 68.2 lbs/acre compared to 25.4 to 88.6 lbs/acre in 2010 (Table 6). Trout abundance and biomass was highest at the Hale Eddy study site in 2009 and the Stilesville study site in 2010.

Compared to long term averages (Table 7), trout abundance in 2009 at Stilesville and the No Kill study sites were comparable to the long term average, up at Hale Eddy and down at Balls Eddy, Trout biomass in 2009 at Stilesville and Balls Eddy were comparable to the long term averages, down at the No Kill, and up at Hale Eddy (Table 7). The trout estimate and biomass for Hale Eddy in 2009 was a record high. In 2010, trout abundance and biomass was higher than the long term averages for the Stilesville, No Kill, and Balls Eddy study site. Trout abundance was down at Balls Eddy but the biomass was comparable to the long term average.

Brown trout dominated fish collections both years. In 2009 and 2010, a total of 2,417 yearling and older trout (excluding recaptures) were collected including 2,209 wild brown trout, 188 rainbow trout, 18 hatchery brown trout, and 2 brook trout. Rainbow trout generally become more abundant down river. Brown trout comprised 95 to 96% of the trout collected at the Stilesville study site compared to 53 to 59% at the Balls Eddy study site. Of the 2,417 trout collected in 2009 and 2010, 24% were legal (≥ 12 in) size, 16% were 16 inches or larger, and 2% were 20 inches or larger, (Table 8). In 2009, the Balls Eddy study site had the highest percentage for all three size groups; however, the sample size was small (36 fish) and may not be representative. In 2010, the No Kill study site had the highest percentage of legal size trout and trout 16 inches or larger with the Hale Eddy study site having the highest percentage of 20 inch or larger trout.

The abundance and size distribution of yearling and older wild brown trout collected during this and earlier studies are shown in Figure 3. Fish under nine inches, which consists primarily of yearling with some small two year old brown trout, generally dominated fish

collections in 2009 and 2010. The exception is the 2009 fish collection at Balls Eddy (Figure 3). The record abundance of trout and brown trout at Hale Eddy in 2009 was due to very abundant yearling brown trout which was attributed to the dense aquatic weed beds present that year. Normally aquatic weeds are very sparse at this study site.

UPPER EAST BRANCH

Air Temperature

The Deposit weather station in 2008, 2009, and 2010 recorded a maximum air temperature of 94°F, 90°F, and 96°F, respectively. Temperatures 90°F or higher occurred on three days in 2008, once in 2009, and seven days in 2010. The summer (June 1-Sept 15) of 2010 was the warmest of the three summers that FFMP was in effect with 37 days that the air temperature was 85°F or higher compared to 19 days in 2008 and 11 days in 2009. The summer of 2009 was unusually cool with 45 days when the air temperature was 75°F or lower compared to 26 days in 2008 and 28 days in 2010.

Peak Flows

Peak flows at the USGS gage at Harvard for 2008, 2009, and 2010 were 10,500, 4,500, and 7,990 cfs, respectively. These peak flows were low compared to the peak flow of 20,600, 21,300, and 22,100 cfs recorded in 2004, 2005, and 2006, respectively. The 2004, 2005, and 2006 peak flow events ranked third, second, and first for the 52 year period since 1954.

Spill Mitigation Releases

Spill mitigation releases, ranging from 74 to 704 cfs, were made to the upper East Branch on 459 days between September 1, 2008 and May 31, 2011 (Table 4). These releases were made

most frequently during the winter and spring quarters. The high frequency of summer spill mitigation releases in 2009 was due to the wet summer and high reservoir levels.

Summer Water Temperatures

No thermal stress days were recorded at any of the seven upper East Branch tailwater temperature monitoring stations during the 2008-10 summer (June1-Sept 15) monitoring period (Table 5). This is in contrast to the 21 and 35 thermal stress days recorded at Fishs Eddy, which is 4.6 miles downstream of the East Branch temperature monitoring site, on the lower East Branch in 2008 and 2010, respectively (Table 5). The maximum water temperature recorded on the Upper East Branch was 73.2°F in 2008, 67.5°F in 2009, and 73.2°F in 2010. The number of summer days that the Upper East Branch daily maximum water temperature was 70°F or higher totaled 12 days in 2008, 0 days in 2009, and 14 days in 2010.

The longitudinal daily average summer water temperature profiles for the 2008-10 monitoring period at Downsville, Harvard, East Branch and Fishs Eddy is illustrated in Figure 4. See Appendices 1, 2, and 3 for the daily maxima, average, and minima water temperature for each individual temperature monitoring station on the East Branch for the 2008-10 study period. Average daily summer, (June 1-Sept.15) were coolest at Downsville and warmest at East Branch. At Downsville in 2008, 2009, and 2010, the highest average daily water temperature recorded was 50.2°F, 53.3°F, and 50.2°F, respectively. The highest summer daily average water temperature at Harvard was 68.4°F in 2008 and 2010 and 65.4°F in 2009. At the East Branch monitoring station, the highest summer daily average water temperature recorded in 2008, 2009, and 2010 was 70.9°F, 63.8°F, and 70.9°F, respectively.

During the summer of 2008 and 2010, the daily average summer water temperature at Downsville was less than 50°F for all but one day. In 2009, there were five days when the average summer water temperature at Downsville was 50°F or higher. The number of days at Harvard where the daily average summer water temperature was above 65°F in 2008, 2009,and 2010 totaled 13, 1, and 11 days, respectively. At the East Branch monitoring station, there were 28 days in 2008 and 29 days in 2010 compared to 0 days in 2009 where the daily average summer water temperature was 65°F or higher. The daily average summer water temperature was 70°F or higher at the East Branch monitoring site for 12 days in 2008 and 2 days in 2010.

Thermal Releases

No thermal releases were made to the upper East Branch during the FFMP study period.

Trout Populations

The four standardized sites on the Upper East Branch were sampled from 2008 through 2010. See Appendices 4, 5, and 6 for the site specific trout catch for the 2008-10 study period. Trout density ranged from 11 to 235 fish/acre in 2008, 21 to 217 fish/acre in 2009, and 16 to 413 fish/acre in 2010 (Table 6). Trout biomass in 2008 ranged from 6.2 to 19.5 lbs/acre, 11.5 to 24.3 lbs/acre in 2009, and 12.1 to 49.0 lbs/acre in 2010 (Table 6). Trout abundance was highest for all three years at the T28 Pool study site. The highest trout biomass was recorded in 2008 and 2010 at the T 28 study site and at the Cabin Pool study site in 2009.

Trout abundance at the Airport Pool was down for all three years compared to the long term average and up for all three years at the T28 Pool (Table 7). At the Cabin Pool, trout abundance was down in 2008, similar in 2009, and up in 2010 compared to the long term

average. At the T 22 Pool, trout abundance was down in 2008, up in 2009, and similar in 2010 compared to the long term averages.

Brown trout dominated fish collections for the 2008-10 monitoring period. During the three year study, a total of 1,487 yearling and older trout (excluding recaptures) were collected, including 1,470 wild brown trout, 9 hatchery brown trout, 6 rainbow trout, 1 brook trout, and 1 hatchery rainbow trout. Of the 1,487 trout collected over this three year period, 4% were legal (≥ 12 in.) size, 2% were 16 inches or larger, and 1% were 20 inches or larger (Table 8). Except for 2010, the T22 study site had the highest percentage of legal size and larger trout; however, the sample size was very small at 12 to 19 trout annually and may not be representative.

The abundance and size distribution of yearling and older wild brown trout during this and earlier studies are shown in Figure 5. Fish under 9 inches, which consists primarily of yearling with some small two year brown trout, dominated the 2008-10 fish collections.

NEVERSINK RIVER

Air Temperature

The Liberty weather station in 2008, 2009, and 2010 recorded maximum air temperature of 91°F, 90°F, and 95°F, respectively. Temperatures 90°F or higher occurred on four days in 2008, once in 2009, and four days in 2010. Both the 2008 and 2010 summers (June 1-Sept.15) were equally warm as both had four days of 90°F or higher air temperatures. In 2008, there were 15 days when summer air temperatures were 85°F or higher compared to 18 days in 2010. The summer of 2009 was unusually cool with 72 days when the air temperature was 75°F or lower compared to 49 days in 2008 and 40 days in 2010.

Peak Flows

Peak flows at the USGS gage in Bridgeville for 2008, 2009, and 2010 were 7,640, 3,860, and 4,460 cfs, respectively. These peak flows were low compared to the record flows of 25,900, 12,500, and 11,100 recorded in 2005, 2006 and 2007. Since the gage was established in 1993, the 2005, 2006, and 2007 peak flows ranked first, second, and third, respectively.

Spill Mitigation Releases

Spill mitigation releases, ranging from 60 to 203 cfs, were made to the Neversink River on 452 days between June 1, 2009 and May 31, 2011 (Table 4). No such releases were made between June 1, 2008 and May 31, 2009. These releases were made most frequently during the winter and spring quarters. The high frequency of summer spill mitigation releases in 2009 was due to the wet summer and high reservoir levels that year.

Water Temperatures

A total of 11 thermal stress days were recorded at the five Neversink River tailwater temperature monitoring stations during the 2008-10 summer (June 1-Sept 15) monitoring period (Table 5). Thermal stress days were only recorded at the Bridgeville monitoring station with two in 2008 and nine in 2010 (Table 5). The maximum water temperatures recorded was 76.6°F in 2008, 72.5°F in 2009, and 77.7°F in 2010. The number of summer days that the Neversink River daily maxima water temperature was 70°F or higher totaled 37 days in 2008, 9 days in 2009, and 53 days in 2010.

The longitudinal daily average summer water temperature profiles for the 2008-10 monitoring period at Hasbrouck, Fallsburg, and Bridgeville are illustrated in Figure 6. See Appendices 1, 2, and 3 for the daily maxima, average, and minima water temperature for each

individual temperature monitoring station on the Neversink River for the 2008-10 study period. Average daily summer water temperatures were coolest at Hasbrouck and warmest at Bridgeville. At Hasbrouck in 2008, 2009, and 2010, the highest daily average summer water temperature recorded was 58.7°F, 69.4°F, and 56.3°F, respectively. The highest summer daily average water temperature at Fallsburg was 62.7 ˚F in 2008, 70.1˚F in 2009, and 62.0˚F in 2010. At Bridgeville in 2008, 2009, and 2010, the highest daily average summer water temperature was 71.0˚F, 69.4˚F, and 72.6˚F, respectively. The warmer daily average summer water temperature in 2009 compared to the 2008 and 2010 was due to spillage at the Neversink Reservoir dam from June 17 through June 26 and July 31 through August 4.

During the summer of 2008 and 2010 at Hasbrouck, the average daily water temperature was less than 55˚F for all but five and two days, respectively. In 2009, the average summer water temperature was 55˚F or higher on 33 days and 60˚F or higher for 13 days. At Fallsburg from 2008 through 2010, the number of days that the daily average summer water temperature was 60˚F or higher averaged 19 days (range was 18-20 days). The number of days at Bridgeville when the daily average summer water temperature was 65˚F or higher totaled 44 days in 2008, 26 days in 2009, and 64 days in 2010 with only one day in 2008, 0 days in 2009, and six days in 2010 when the average daily water temperature was 70˚F or higher.

Thermal Releases

No thermal releases were made to the Neversink Tailwaters during the FFMP study period.

Fish Populations Studies

The three standardized sites on the Neversink River were sampled from 2008 through 2010. See Appendices 4, 5, and 6 for the site specific trout catch for the 2008-10 study period.

Trout density ranged from 45 to 165 fish/acre in 2008, 76 to 273 fish/acre in 2009, and 44 to 337 trout/acre in 2010 (Table 6). Trout biomass in 2008 ranged from 23.7 to 99.7 lbs/acre, 19.4 to 117.9 lbs/acre in 2009, and 18.6 to 141.2 lbs/acre in 2010 (Table 6). Trout abundance and biomass for all three years was highest at the Ranch Road site.

Compared to long term averages (Table 7) trout abundance at Hasbrouck was down in 2008 and 2010 and up in 2009. At Fallsburg, trout abundance was up in 2009 and comparable in 2008 and 2010. At Ranch Road, trout abundance was up in 2009 and 2010 and comparable in 2008 to the long term averages.

Brown trout dominated fish collection for the 2008-10 monitoring period. During this three year period, a total of 385 yearling and older trout (excluding recaptures) were collected including 319 wild brown trout, 60 hatchery brown trout, and 6 brook trout. Of the 385 trout collected over the three year period, 24% were 12 inches and larger, 8% were 16 inches and larger and only 0.2% were 20 inches and larger (Table 8). The Ranch Road site had the highest percentage of trout that were 12 inches and larger. The Hasbrouck site had the highest percentage of trout that were 16 inches and larger. Trout 20 inches and larger were very rare with only one individual collected at Hasbrouck in 2008. The abundance and size distribution of yearling and older brown trout during this and earlier studies are shown in Figure 7. Fish under 9 inches, which consists primarily of yearling with some small two year brown trout, dominated the 2008-10 fish collections.

DELAWARE RIVER

Air Temperature

The Deposit weather station in 2008, 2009, and 2010, recorded maximum air temperatures of 94°F, 90°F, and 96°F, respectively. Temperatures 90°F or higher occurred on three days in 2008, once in 2009, and seven days in 2010. The summer (June 1-Sept 15) of 2010 was the warmest of the three years that FFMP was in effect. There were 37 days that summer when the air temperature was 85°F or higher compared to 19 days in 2008 and 11 days in 2009. The summer of 2009 was unusually cool with 49 days when the maximum air temperature was 75°F or lower compared to 26 days in 2008 and 28 days in 2010.

PEAK FLOWS

Peak flows at the USGS gage in Callicoon for the 2008, 2009, and 2010 were 46,200, 30,900, and 35,500 cfs, respectively. These peak flows were low compared to the peak flows of 107,000, 114,000, and 144,000 cfs recorded during 2004, 2005, and 2006, respectively. The 2004, 2005, and 2006 peak events ranked third, second, and first since the Callicoon gage was established in 1976.

Summer Water Temperatures

The number of thermal stress days ranged from none at four temperature monitoring stations in 2009 to 58 at Callicoon in 2010 (Table 5). Thermal stress days in 2008 and 2010 increased from the upstream to downstream monitoring sites. At Lordville (RM 321), there were 18 thermal stress days in 2008, 0 in 2009, and 25 in 2010 (Table 5). At Callicoon (RM 303), there were 45 thermal stress days in 2008, 4 in 2009, and 58 in 2010 (Table 5). The maximum summer water temperature recorded on the upper Delaware River in 2008, 2009, and 2010 was 84.7°F,

78.3°F, and 86.7°F, respectively. The number of summer (June 1-Sept 15), days that the daily maxima water temperature was 70°F or higher was 92 days in 2008, 29 days in 2009, and 78 days in 2010 at Callicoon compare to 58 days in 2008, 7 days in 2009, and 52 days in 2010 at Lordville.

The longitudinal daily average summer water temperature profiles for the 2008-10 monitoring period at Leonards, Abe Lord, and Callicoon are illustrated in Figure 8. See Appendices 1, 2, and 3 for the daily maxima, average, and minima water temperature for each individual temperature monitoring station on the upper Delaware River. Summer daily average water temperatures were coolest at Leonards and warmest at Callicoon. At Leonards in 2008, 2009, and 2010, the highest average daily summer water temperature was 74.2°F, 68.2°F, and 74.2°F, respectively. The highest summer average water temperature at Abe Lord was 77.8°F in 2008, 70.6° in 2009, and 77.4°F in 2010. At Callicoon, it was 80.7°F in 2008, 75.1°F in 2009, and 83.1°F in 2010. At Leonard's, the average daily water temperature was 70°F or higher for 19 days in 2008 and 20 days in 2010, but less than 70°F all summer in 2009. The number of days at Abe Lord where the daily average summer water temperature was 70°F or higher totaled 34 days in 2008, 1 day in 2009, and 41 days in 2010 including three days in 2008 and seven days in 2010 when the daily average water temperature was 75°F or higher. At Callicoon in 2008, 2009, and 2010, there were 68, 11, and 62 days when the daily average summer water temperature was 70°F or higher including 25, 1, and 34 days when the average daily water temperature was 75°F or higher.

Thermal Releases

Thermal releases were made to the West Branch on two occasions to alleviate thermal stress to trout in the Delaware River. During the summer of 2008 and 2010, thermal releases were made over a three day period each year. Thermal releases in 2008 ranged from 274 to 657 cfs and 514 to 524 cfs in 2010 (Table 4).

Spill Mitigation Releases

Although spill mitigation releases are not made to the Delaware River, it does benefit from those releases that are made to the upper East Branch and West Branch. Summer spill mitigation releases from the West Branch are most beneficial because of the beneficial impacts to water temperatures. See Table 4 for the seasonal frequency of spill mitigation releases to the West Branch and East Branch.

Trout Population Studies

No trout sampling occurred on the Delaware River during the FFMP monitoring period.

DISCUSSION

FFMP represents a major improvement over Revision 1 which remains the only approved Decree Parties releases program for the upper Delaware. As such, the Decree Parties can mandate a return to Revision 1 anytime they choose. Revision 1 was in effect from 1983 through 1996. Since then, various experimental releases programs have been implemented with FFMP the latest version. Figure 9 compares the original FFMP and Revision 1 releases for the West Branch, East Branch, and the Neversink River. Except for 60 days on the West Branch between June 15 and August 15 and 61 days in April and October on both the East Branch and Neversink River, FFMP releases were higher than Revision 1 releases. The shortfall on the West Branch

under FFMP was eliminated when the summer releases were increased from 260 cfs to 325 cfs for 2009 and 2010. Another major advantage of FFMP was that releases to all three rivers during drought watch, warning, and emergency were increased dramatically. Prior to implementation of FFMP, drought watch, warning, and emergency releases which varied depending on time of year ranged from 8 to 23 cfs on the West Branch, 6 to 19 cfs on the East Branch, and 5 to 15 cfs on the Neversink River. Under FFMP, drought releases to the West Branch were 50 to 175 cfs, 40 to 100 cfs to the East Branch, and 25 to 75 cfs to the Neversink River (Table 1).

Despite the improvement of FFMP over Revision 1, FFMP was not necessarily an improvement over Revision 7 (May1, 2004 to Sept 30, 2007) which immediately proceeded implementation of FFMP. Revision 7 differed from all other releases program to date in that it was designed to maintain habitat flow targets throughout the year as follows: 225 cfs on the West Branch at Hale Eddy, 175 cfs on the upper East Branch at Harvard, and 115 cfs on the Neversink River at Bridgeville. Releases were adjusted daily as needed to maintain the habitat flow targets. Additional releases could be made for thermal protection and this included the Delaware River. In retrospect, the West Branch summer flow target should have been at least 325 cfs. The defiencies of Revision 7 were many. It was very labor intensive because of the daily monitoring that was required to ensure that flow and temperature targets were being met and the increased record keeping. The 20,000 cfs Habitat Bank created annually under Revision 7 was too small to meet both habitat and temperature targets. As a result, thermal protection was eliminated in June, 2006 to ensure that flow targets on the three tailwater rivers were met for the longest period possible. According to Elliot et al (2005), the Habitat Bank was expected to be adequate for

about 50% of the historic water years. Lastly, releases could be reduced to a minimum during periods of high run off.

An early problem of FFMP became apparent in late spring, 2008, as multiple transitions between FFMP reservoir release rates over short periods of time resulted in large, frequent variations in streamflow, particularly to the West Branch. This "bouncing" or "yo-yoing" resulted in numerous complaints by anglers. Improved procedures were needed to avoid automatic adjustment of release rates based only on the storage thresholds incorporated in the rule curves of the FFMP. To address this issue, the Decree Parties adopted the following FFMP modification June 1, 2009:

> *To more naturally affect downward or upward transitions between discharge mitigation rates may be ramped in cooperation with NYSDEC, generally over a period of three days at Cannonsville and Pepacton Reservoirs or two days at Neversink Reservoir.*

Adoption of this modification corrected the yo-yoing that occurred in the spring of 2008 since there has been no complaints since.

River Master directed releases, typically made to the West Branch, are common during a relatively dry summer or fall such as experienced in 2008 and 2010. These directed releases are necessary to maintain the flow target at Montague, New Jersey (Figure 1) and can continue into the early and late fall. Thus, West Branch flows can be much higher then the scheduled base releases. The problem occurs when the weather forecasts calls for heavy precipitation in the Delaware River basin. Consequently, the directed release is rapidly reduced to the base release three to four days prior to the projected rains. In 2010, the 800 cfs release on September 28 was reduced to 116 cfs on September 29. This rapid reduction in release even with ramping dewaters large sections of the West Branch and the Delaware River. When this occurs, complaints to

DEC, NYCDEP, and the DRBC are numerous. Water is not the issue because the River Master may order a resumption of directed releases if the forecasted precipitation does not occur or is much lighter than projected. This problem, which is not unique to FFMP, can be greatly alleviated by maintaining a 300 cfs release to the West Branch. This release would keep the entire West Branch stream channel wetted which would eliminate angler concerns about dewatering and stranding on the trout population and invertebrate community. The Delaware River would also benefit because the minimum flow would be about 200 cfs higher than what now occurs under this scenario.

Dewatering impacts the trout population by forcing fingerling and yearling trout which are normally found along the stream bank into the deeper water frequented by the larger trout. Predation by the larger trout on these smaller trout could be significant. The overall impact on trout populations is not known. Dewatering also impacts the aquatic invertebrate community. Being much less mobile, invertebrates are often stranded and subject to higher than normal mortality, which will result in reduced populations. These problems, as already stated, can be minimized if the Directed Releases to the West Branch were maintained at 300 cfs until such releases are no longer required. Inevitably, River Master directed releases will end with releases returning to potentially low levels specified in the release protocols.

The biggest disadvantage of FFMP was that the 6,000 to 9,000 cfs thermal bank created under Revision 1 that could be used to mitigate spikes in water temperatures stressful to trout was eliminated. The absence of a thermal bank to mitigate warming water temperatures,

primarily in the Delaware River, is a major issue among anglers whose concerns were realized by the June 2008 heat wave. This heat wave resulted in peak water temperatures of 81.1°F at Lordville and 84.7°F at Callicoon with 75°F or warmer temperatures for seven consecutive days at Lordville and 10 days at Callicoon. The mean daily water temperature was 70°F or warmer for 8 continuous days at Lordville and 11 days at Callicoon. These very stressful water temperatures with no mitigation resulted in numerous complaints to DEC, NYCDEP, and DRBC. The growing public pressure resulted in thermal releases of 274 to 657 cfs for the June 9-11 period. Following this emergency thermal release, the Decree Parties agreed to establish a 1,340 cfs bank but it could only be used when the three day average of forecasted daily maximum air temperatures for the Hancock area exceeds 90°F and the minimum exceeds 65°F. Angling groups remain dissatisfied because the thermal bank was too small and its use was too stringent.

Contrary to popular opinion, FFMP did not worsen the worsen summer water temperatures in the Delaware River. Figures 10 and 11 shows the frequency of summer days that the daily maximum and average water temperature was at least 70°F, 72°F, 75°F, and 80°F at Lordville and Callicoon. The frequency of warm water summer water temperatures in the Delaware River is comparable to other years when summer weather was warm. It must be pointed out that Cannonsville base releases since 1963 provided minimal thermal benefits to the Delaware River downstream of the confluence of the East and West Branches. Cooling benefits to the Delaware River only occur when large River Master directed releases are made. However, the joint NY-PA joint fisheries paper (2010) recommended improvements to FFMP for the coldwater ecosystems in the Delaware River Tailwaters. This paper recommended a 500-525 cfs summer releases to the West Branch which should provide good habitat and thermal protection to the Delaware River downstream to Lordville, a distance of 10.7 miles. This “good”

designation means that opportunities for a coldwater fishery will be maintained. However, elevated water temperatures will occasionally be an issue and the year-round abundance of coldwater species are not expected to be as prevalent as in sections with the "Excellent" protection level such as the West Branch. Summer water temperatures will occasionally exceed a daily maximum of 75°F for short periods and water temperatures greater than 68°F occur more frequently than for sections with "Excellent" protection.

Despite its inability to maintain suitable summer water temperatures in the upper Delaware River, FFMP was very successful in maintaining suitable summer water temperatures in the West Branch, upper East Branch and Neversink River tailwaters. Average daily summer water temperatures rarely exceeded 70°F and were mostly in the mid to upper 60°F or lower. It was 70°F or higher on the upper East Branch three times (1 in 2008 and 2 in 2010), seven times on the Neversink River (1 in 2008 and 6 in 2010) and never on the West Branch. Another indicator for the effectiveness of FFMP was the absence of thermal stress days on the West Branch and upper East Branch throughout this study and for only 11 days (2 in 2008 and 9 in 2009) on the Neversink River (Table 5). In comparison, the number of thermal stress days on the Delaware River ranged from 8 to 58 in 2008 and 2010 with the number of stress days increasing down river (Table 5).

Frequent and large summer spill mitigation releases have the potential to deplete the coldwater volume in one or more of the three reservoirs (Cannonsville, Pepacton, and Neversink) prior to the end of summer. Such a scenario places both the tailwater and reservoir trout fishery at risk due to elevated water temperatures. The reservoir and river most at risk in this situation are Cannonsville and the West Branch. With the changing weather and climate change, it is only

a matter of time before there is a late August or September heat wave. Were this to occur and the release water was 65°F, the water temperature 17 mi downriver of the dam in the Hancock area could approach or exceed 80°F with a major or potentially catastrophic fish kill occurring. To minimize this potential risk, summer spill mitigation releases from Cannonsville Reservoir should be reduced. Ideally, the coldwater volume in Cannonsville Reservoir should last through at least September 15 but preferably through September 30.

Trout Studies

Trout population studies were conducted on the upper East Branch and Neversink River from 2008 through 2010. The West Branch trout studies were conducted in 2009 and 2010. This data was summarized in the results section and tabulated or illustrated in the tables and figures section. Unfortunately, the 3.7 year period that FFMP was in effect was not a long enough time period to demonstrate positive or negative impacts to the trout populations in these three tailwater rivers. The problem is that sampling was largely evaluating trout populations that reflect river flows and releases in prior years. Stream trout can live up to eight years or so with a new generation produced annually. In the upper Delaware system, the majority of desirable size or catchable trout are three to five years old which typically range from 13 to 20 inches long. FFMP from 2008 through 2010 has an impact on Age 0 trout in 2008, Age 0 and 1 trout in 2009, and Ages 0, 1, and 2 trout in 2010. Due to the small size (≤ 3 inches) of Age 0 trout, the large size of the tailwater rivers, and the boat shocker sampling methodology, a qualitative assessment was not possible and no attempt was made to assess fingerling trout production.

To properly evaluate the impact of FFMP or any other releases program on trout populations, the minimum time frame should be six years and preferably 10 so that the Ages 1-5 year classes fully reflect the releases program being evaluated as demonstrated in Table 9. Trout

older than Age 5 are rare and are not important to any evaluation unless the numbers of older fish increase dramatically. Since year 6 is the first year that Ages 1-5 trout are fully represented, it would be desirable to extend the study through year 10 so that there is five years of data to properly evaluate the impact of a releases program on trout population. From this, it is obvious that an assessment of the impact of FFMP on tailwater trout populations is not possible. Thus, further discussion of the FFMP releases on tailwater trout populations is not warranted. It is recommended that future trout population studies not be part of any short term releases program monitoring requirements.

Consideration also needs to be given for modifying spill mitigation releases particularly from Cannonsville Reservior to the West Branch. Large and frequent summer spill mitigation releases could deplete the coldwater volume which will result in warmer water being released. If this were to occur in conjunction with a late season (September) heat wave, the trout fishery in both the West Branch and Cannonsville Reservoir could suffer a major and potentially catastrophic fish kill. To minimize this risk, summer spill mitigation releases to the West Branch need to be reduced. In any case, a thorough quantitative assessment of the risks associated with depletion of the hypolimnion should be included in the development of any future releases agreement with similar provisions for spill mitigation.

SUMMARY

Overall, FFMP worked well with some glitches that were addressed and corrected once identified. It worked well enough that this FFMP provided the framework for the new releases agreement that took effect June 1, 2011. Among angler groups, two main issues remain that need to be addressed. The first is the small size of the thermal bank (1,340 cfs) created in 2008 and the

restrictions on its use. The other major issue is the large and rapid reduction in release rates from high to the base release rate when a major rain event is forecasted which may or may not occur. As a result, there is widespread rapid dewatering of the stream channel, primarily to the West Branch and Delaware River, which causes stranding and mortality of aquatic invertebrates. This dewatering also forces fingerling and yearling trout from the edges of the river to deeper water where they are subject to increased predation by larger trout. The short and long term impacts of these dewatering events are not known. This is an issue that needs to be addressed.

Consideration also needs to be given for modifying summer spill mitigation releases particularly from Cannonsville Reservoir to the West Branch. Large and frequent summer spill mitigation releases could deplete the coldwater volume which will result in warmer water being released. If this were to occur in conjunction with a late August or September heat wave, the trout fishery in both the West Branch and Cannonsville Reservoir could suffer a major and potentially catastrophic fish kill. In the absence of a more rigorous quantitative risk assessment, summer spill releases to the West Branch need to be reduced to minimize this risk.

Trout populations were unaffected by FFMP. Since it takes six years for the Ages 1-5 yearlings of trout to fully reflect the releases program being evaluated, it was recommended that future trout population studies not be part of any short term releases program monitoring requirements.

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Sheppard, J.D. 1983. New York Reservoir releases monitoring and evaluation program: summary report. NYS Department of Environmental Conservation, Bureau of Fisheries, Albany, NY: 151 pp.

Figure 1: Map of the upper Delaware tailwaters.

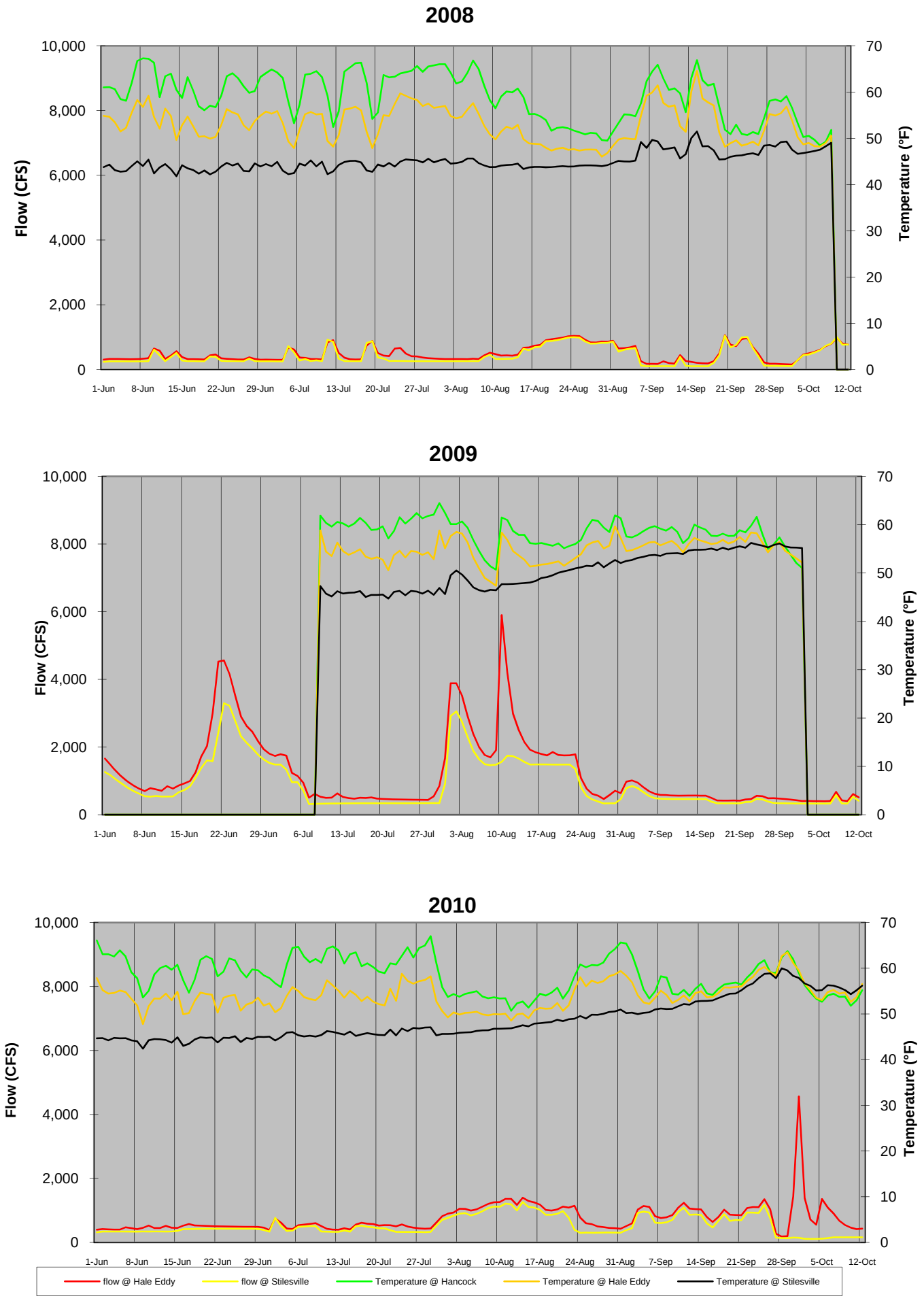


Figure 2: Longitudinal summer daily average water temperature profile on the West Branch at Stilesville, Hale Eddy, and Hancock along with daily average flows at Hale Eddy and Stilesville, 2008-2010.

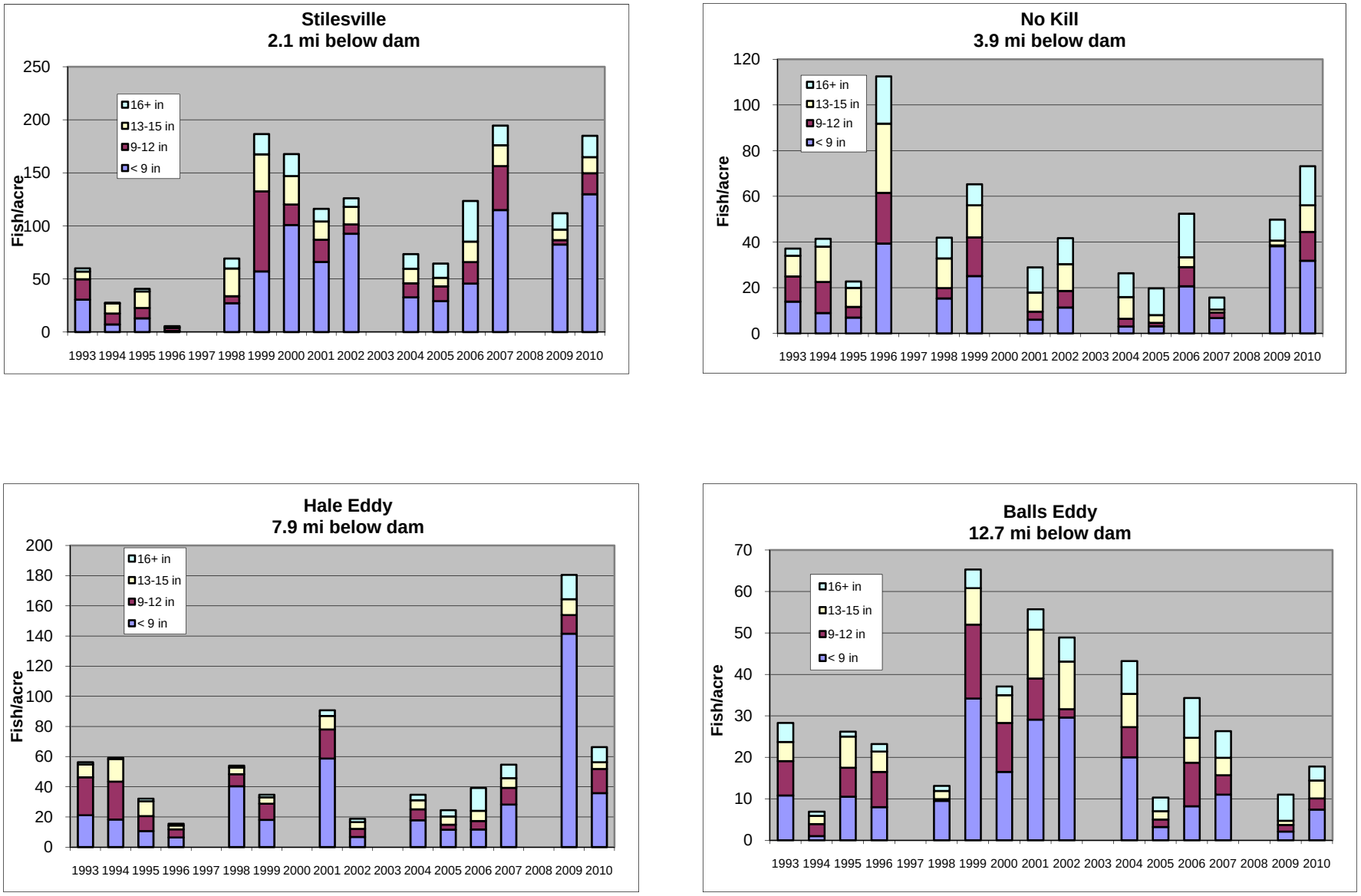


Figure 3: Abundance of yearling and older wild brown trout by size group at four West Branch study sites, 1993-2010.
Note: vertical scale is different for each graph.

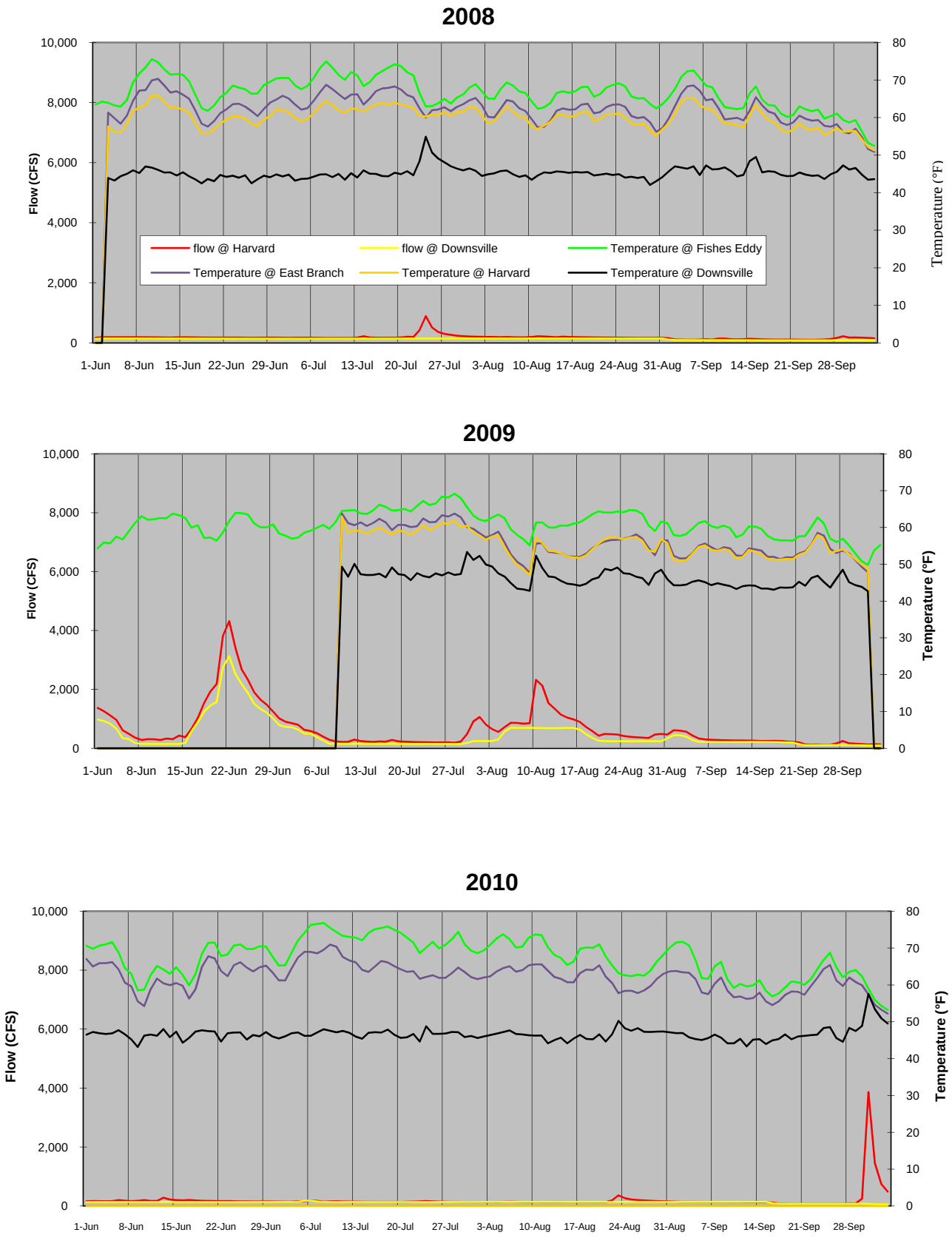
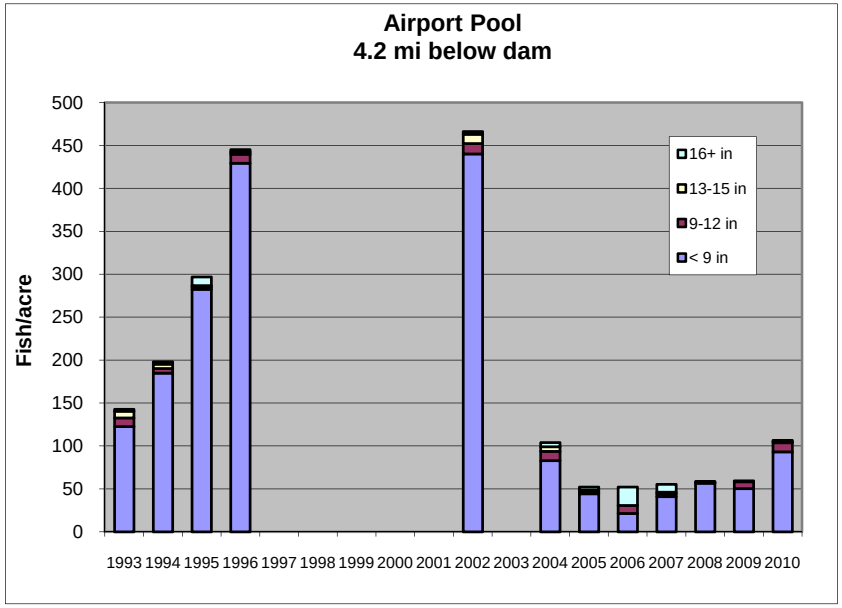
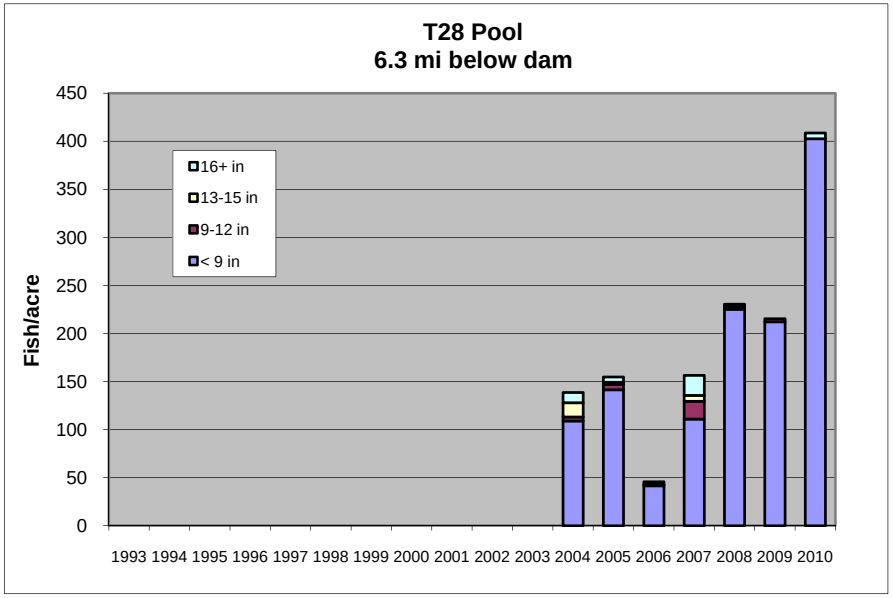
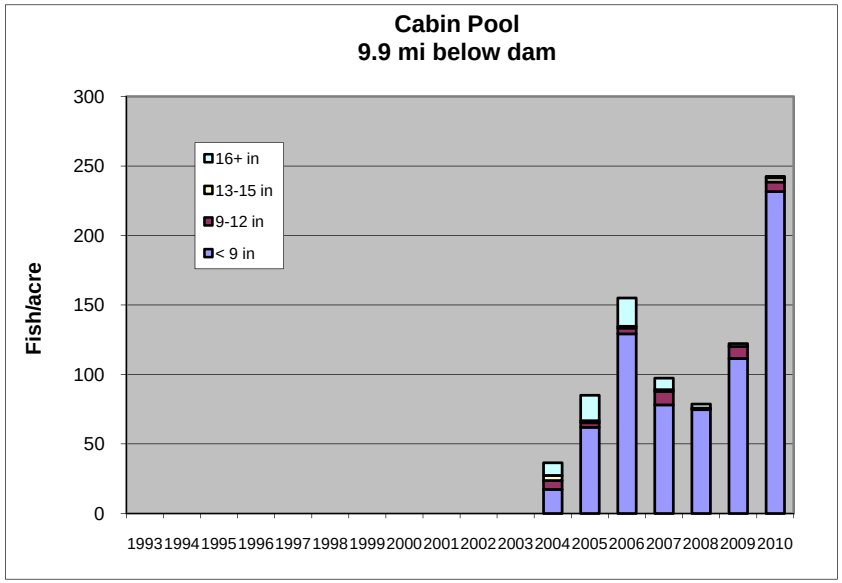


Figure 4: Longitudinal summer daily average water temperature profile on the East Branch at Downsville, Harvard, East Branch, and Fishs Eddy along with daily average flows at Downsville and Harvard, 2008-10.







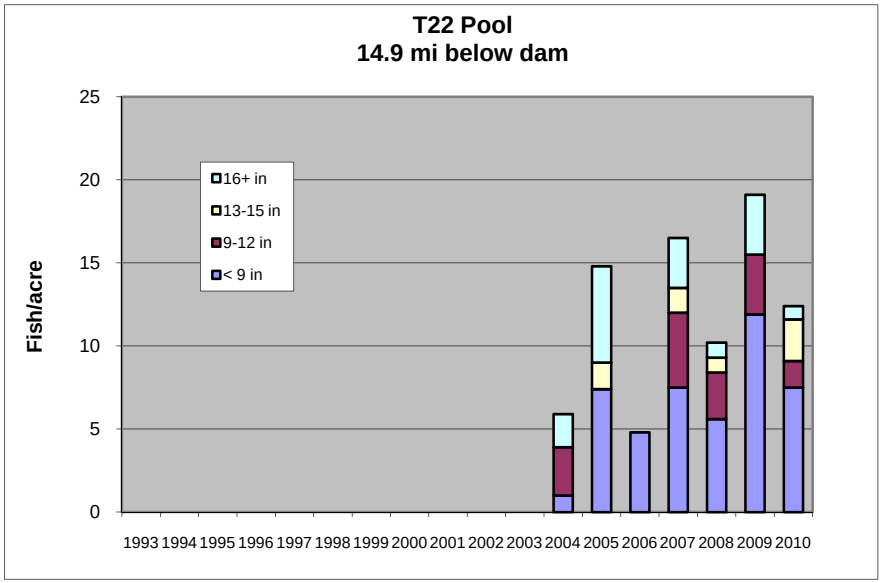


Figure 5: Abundance of yearling and older wild brown trout by size group at four East Branch study sites, 1993-2011.
Note: vertical scale different on each graph.

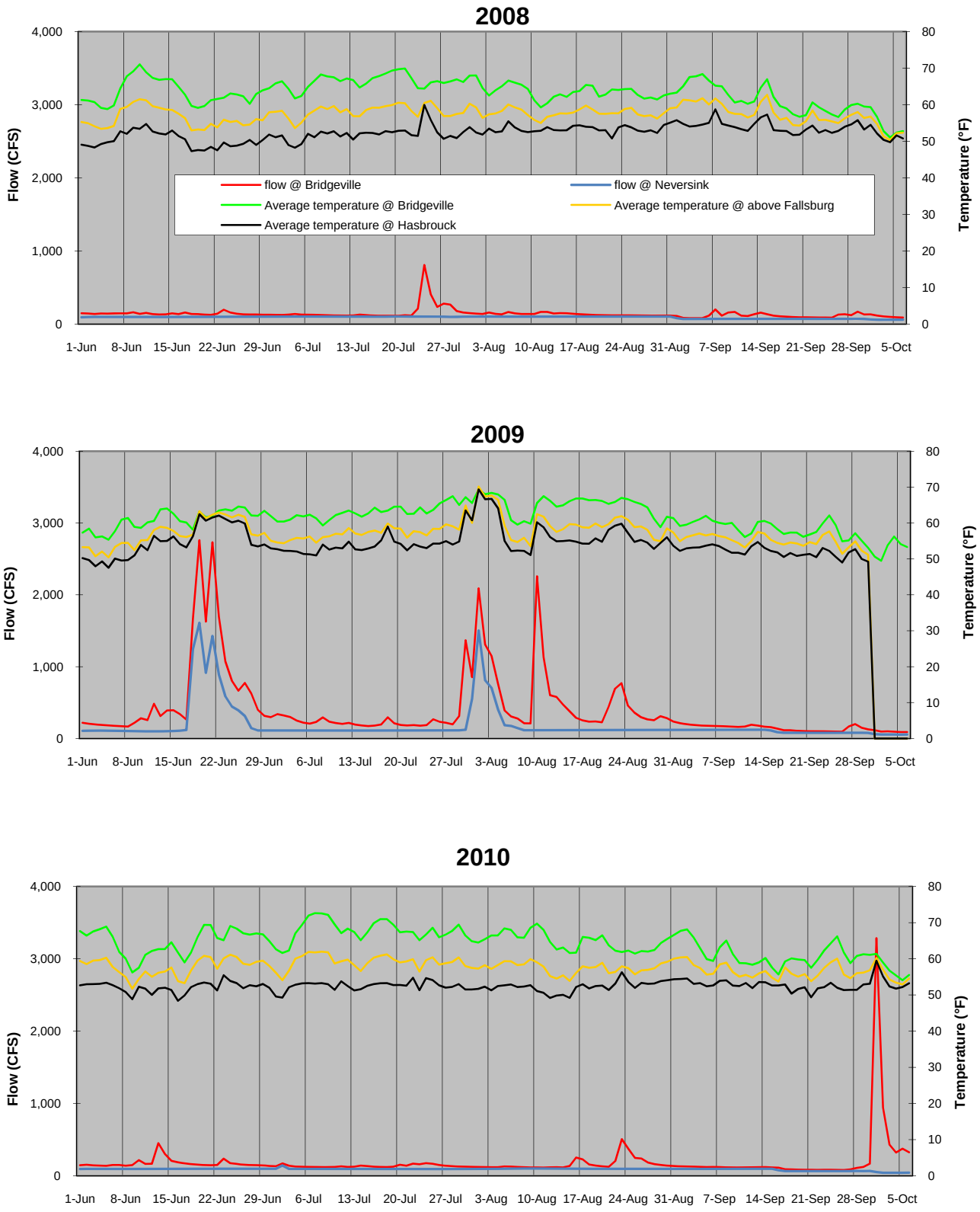


Figure 6: Longitudinal summer average water temperature profile on the Neversink River at Bridgeville, Fallsburg, and Hasbrouck along with daily average flows at Bridgeville and Neversink just below the dam, 2008-10.

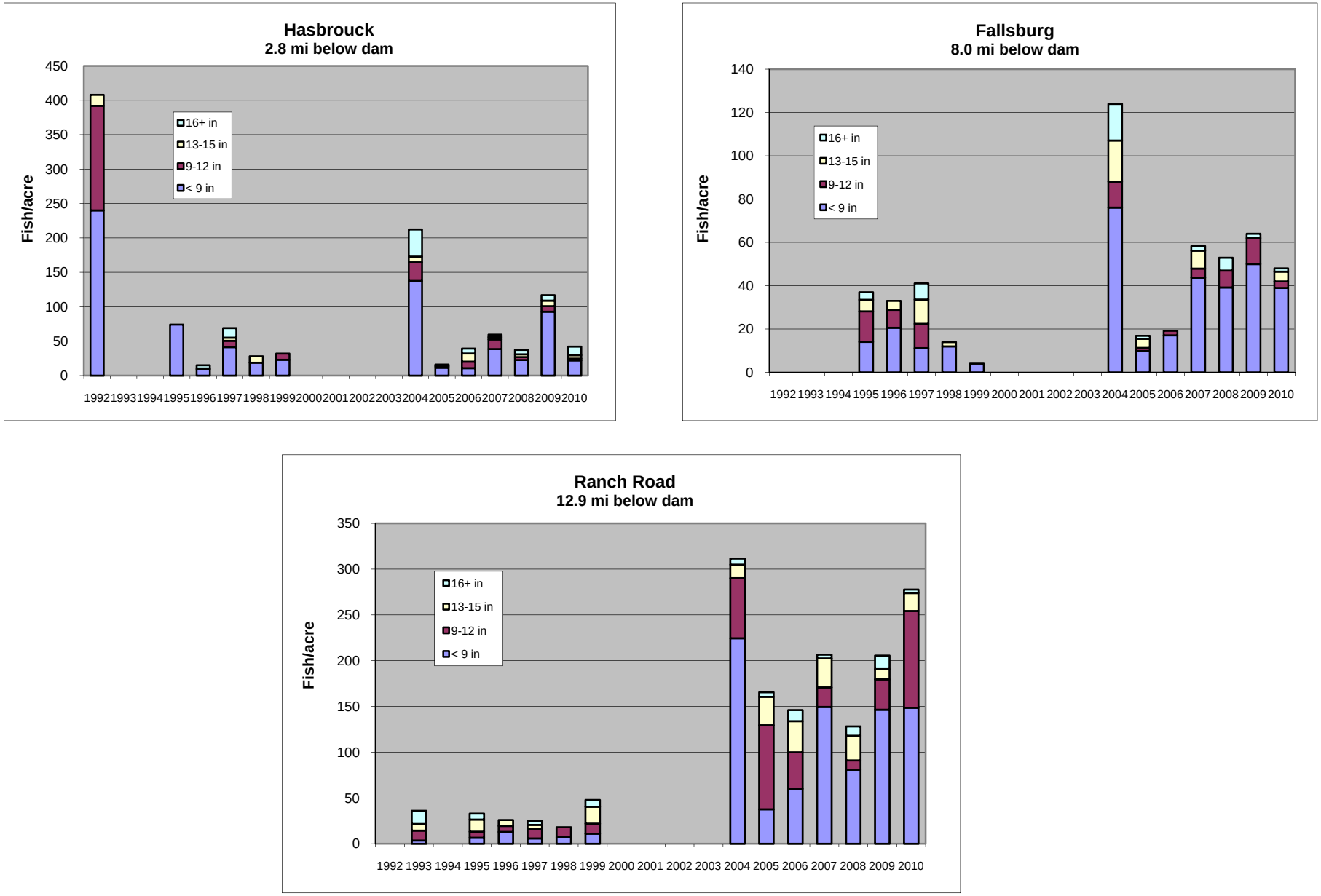


Figure 7: Size distribution of wild brown trout collected from three locations on the Neversink River, 1993-2010.

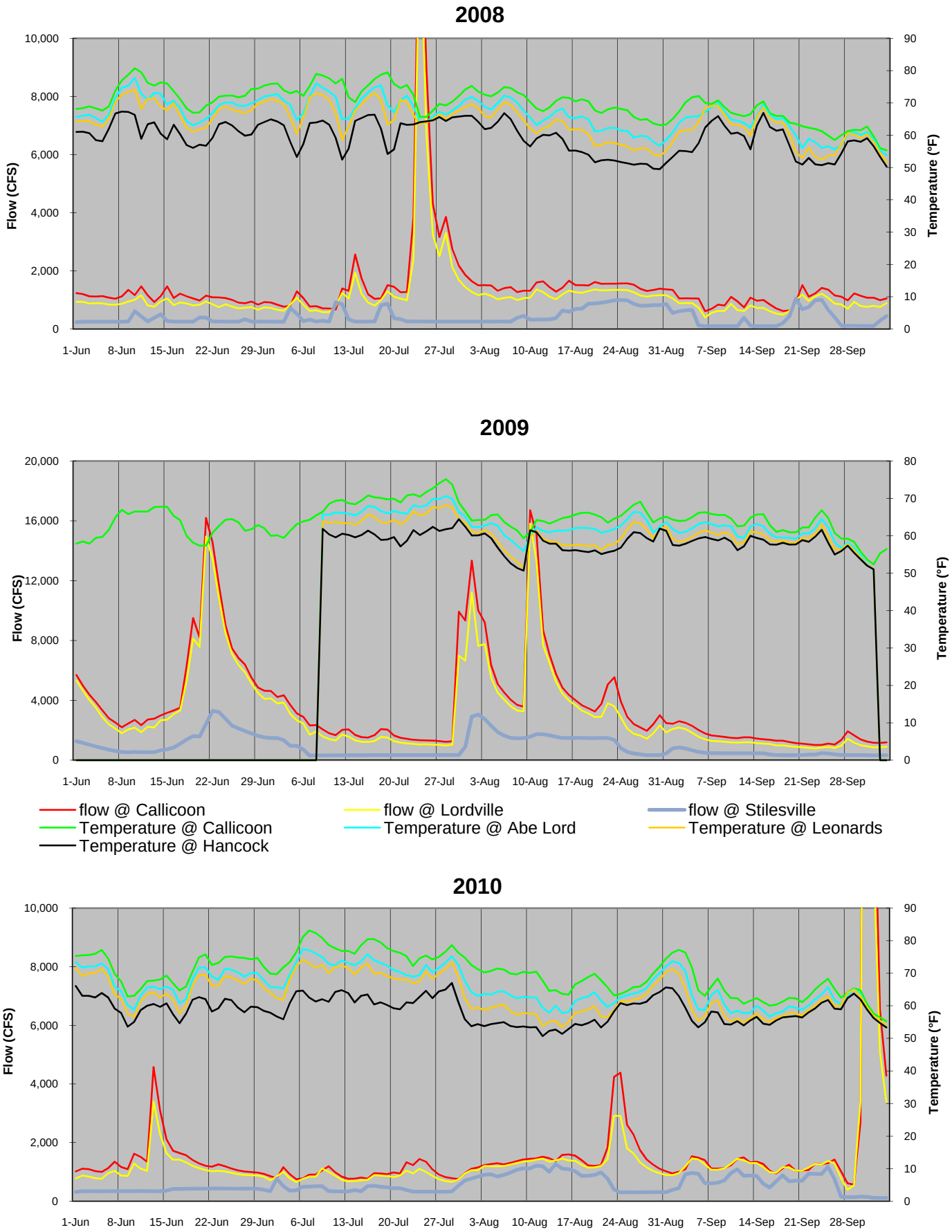


Figure 8: Longitudinal summer daily average temperature profile on the West Branch at Hancock and Leonards Abe Lord, and Callicoon on the Delaware River along with the daily average flows at Stilesville on the West Branch and Lordville and Callicoon on the Delaware River, 2008-2010.

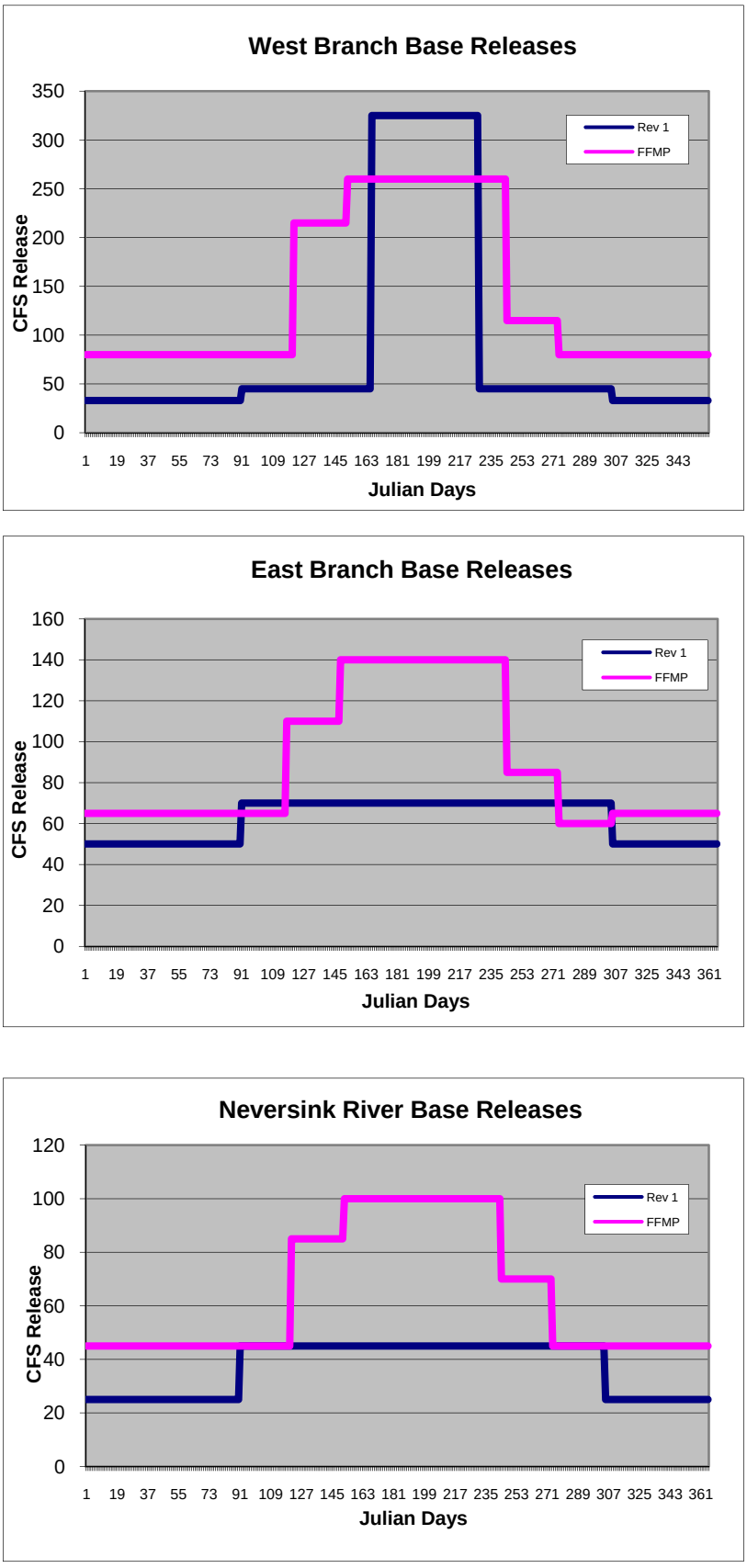


Figure 9: Comparison of Revision 1 and the original FFMP base flow releases from Cannonsville, Pepacton, and Neversink Reservoirs.

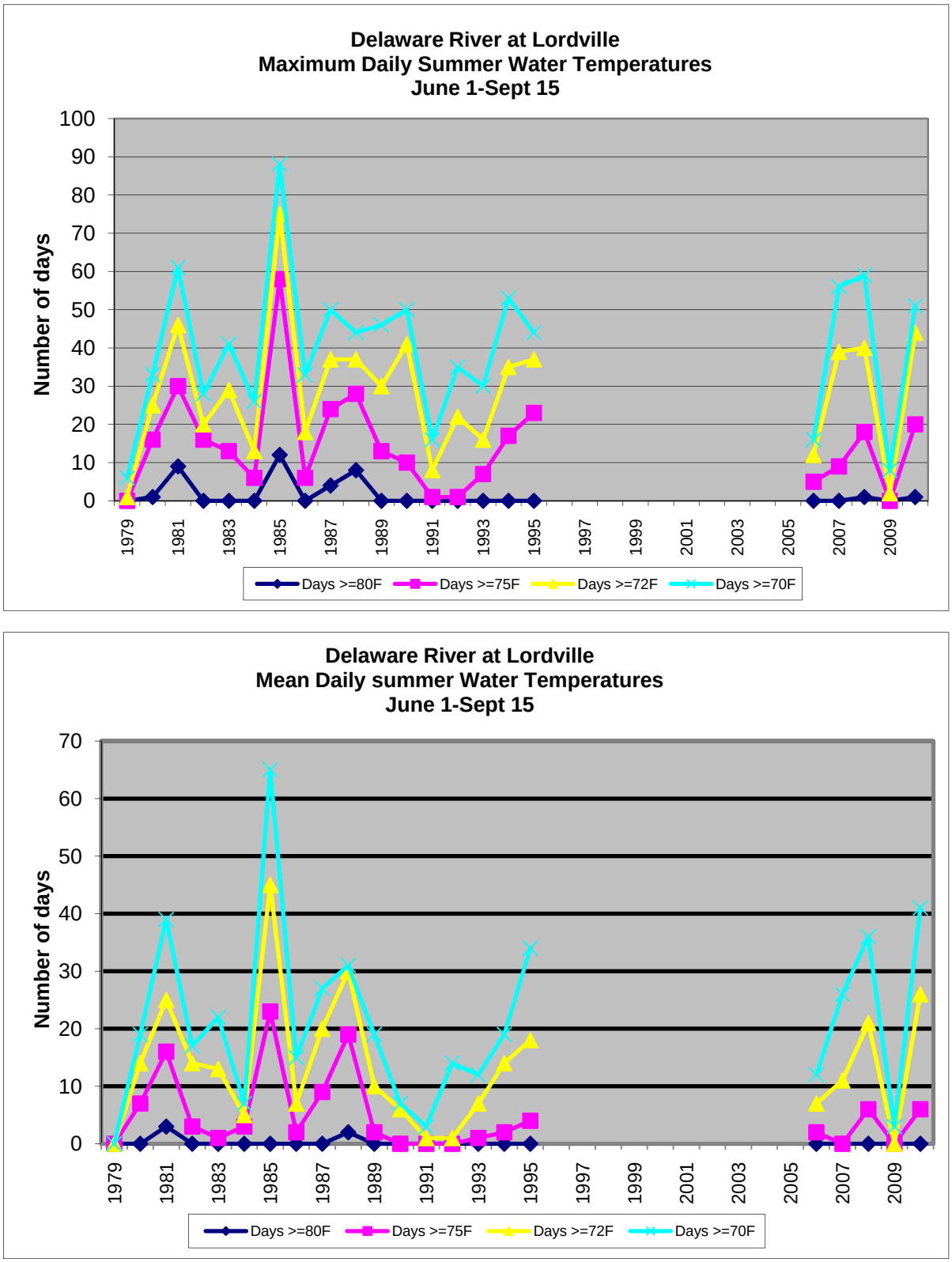
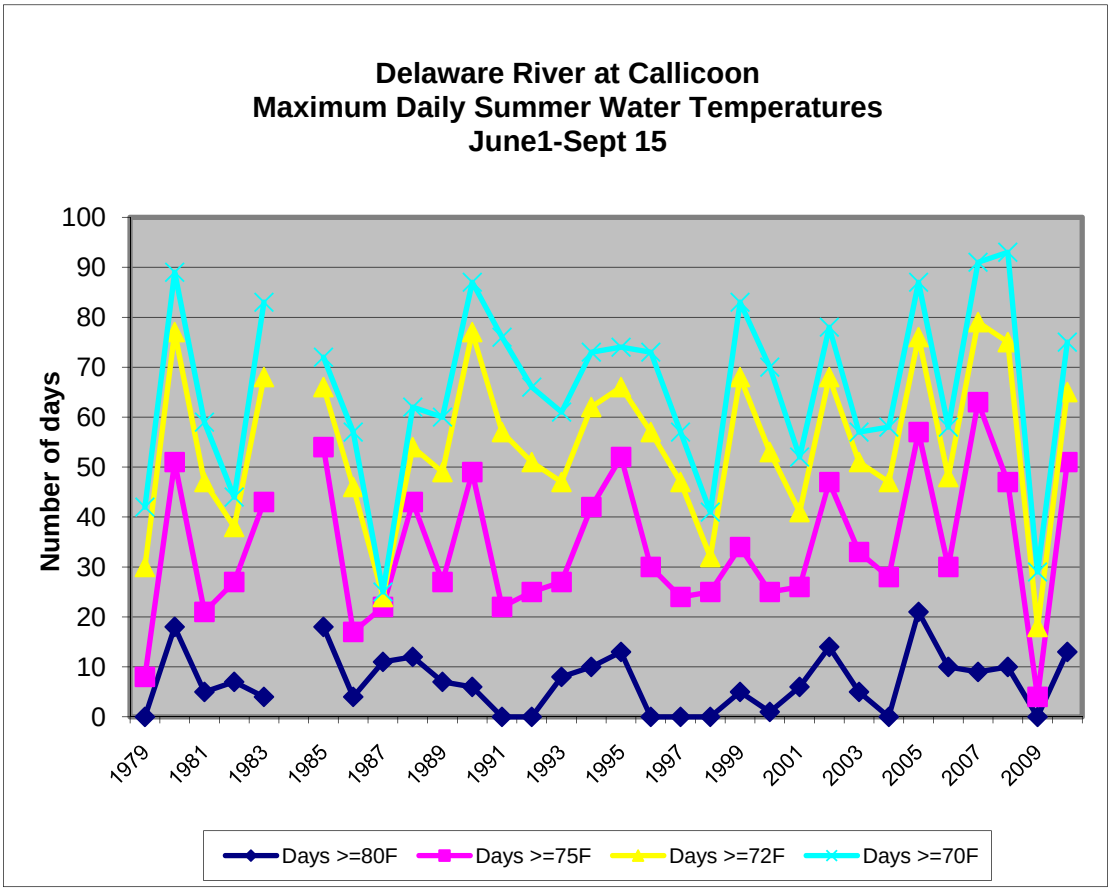


Figure 10: Frequency of average and maximum summer water temperatures for the Delaware River at Lordville, 1979-2010.



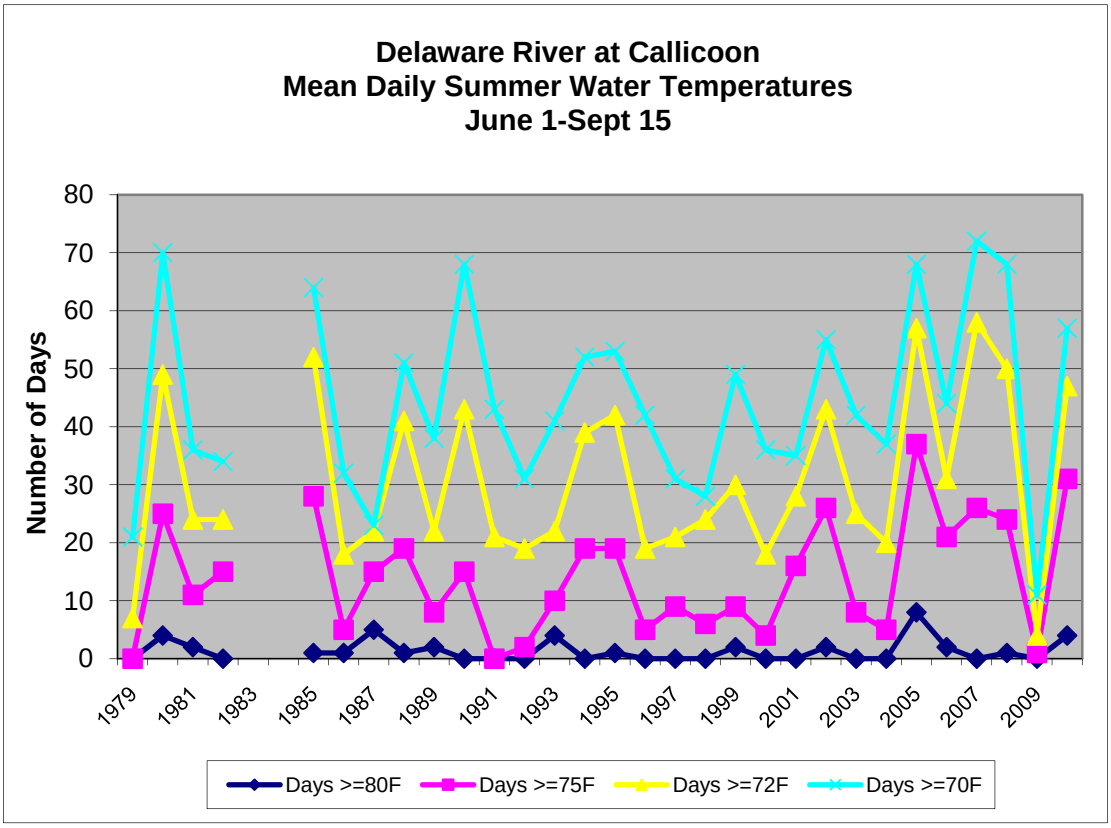


Figure 11: Frequency of mean and maximum summer water temperatures for the Delaware River at Callicoon, 1979-2010.

Table 1: Original schedule of FFMP releases (cfs) from Cannonsville, Pepacton, and Neversink Reservoirs with 35 MGD available. Effective date Oct 1, 2007.

	Winter		Spring	Summer			Fall	
Cannonsville Storage Zone	Dec 1 - Mar 31	Apr 1 - Apr 30	May 1 - May 31	Jun 1 - Jun 15	Jun 16 - Jun 30	Jul 1 - Aug 31	Sep 1 - Sep 30	Oct 1 - Nov 30
L1-a	1500	1500	*	*	1500	1500	1500	1500
L1-b	250	*	*	*	*	350	275	250
L1-c	110	110	225	275	275	275	140	110
L2	80	80	215	260	260	260	115	80
L3	70	70	100	175	175	175	95	70
L4	55	55	75	130	130	130	55	60
L5	50	50	50	120	120	120	50	50

	Winter		Spring	Summer			Fall	
Pepacton Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Oct 1 - 30-Nov
L1-a	700	700	*	*	700	700	700	700
L1-b	185	*	*	*	*	250	200	185
L1-c	85	85	120	150	150	150	100	85
L2	65	65	110	140	140	140	85	60
L3	55	55	80	100	100	100	55	55
L4	45	45	50	85	85	85	40	40
L5	40	40	40	80	80	80	30	30

	Winter		Spring	Summer			Fall	
Neversink Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Oct 1 - 30-Nov
L1-a	190	190	*	*	190	190	190	190
L1-b	100	*	*	*	*	125	85	95
L1-c	65	65	90	110	110	110	75	60
L2	45	45	85	100	100	100	70	45
L3	40	40	50	75	75	75	40	40
L4	35	35	40	60	60	60	30	30
L5	30	30	30	55	55	55	25	25

*Storage zone does not apply during this period. Releases will be made in accordance with zone L1-c.

Table 2: Modified FFMP with split May and September schedule of releases (cfs) with 35 MGD available from Cannonsville, Pepacton, and Neversink Reservoirs. Effective date December 10, 2008.

	Winter		Spring		Summer			Fall		
Cannonsville Storage Zone	Dec 1 - Mar 31	Apr 1 - Apr 30	May 1 - May 20	May 21 - May 31	Jun 1 - Jun 15	Jun 16 - Jun 30	Jul 1 - Aug 31	Sep 1 - Sep 15	Sep 16 - Sep 30	Oct 1 - Nov 30
L1-a	1500	1500	*	*	*	1500	1500	1500	1500	1500
L1-b	250	*	*	*	*	*	350	300	275	250
L1-c	110	110	200	250	275	275	275	275	140	110
L2	80	80	190	240	260	260	260	260	115	80
L3	70	70	100	100	175	175	175	95	95	70
L4	55	55	75	75	130	130	130	55	55	60
L5	50	50	50	50	120	120	120	50	50	50

	Winter		Spring		Summer			Fall		
Pepacton Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	700	700	*	*	*	700	700	700	700	700
L1-b	185	*	*	*	*	*	250	200	200	185
L1-c	85	85	110	130	150	150	150	150	100	85
L2	65	65	100	125	140	140	140	140	85	60
L3	55	55	80	80	100	100	100	55	55	55
L4	45	45	50	50	85	85	85	40	40	40
L5	40	40	40	40	80	80	80	30	30	30

	Winter		Spring		Summer			Fall		
Neversink Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	190	190	*	*	*	190	190	190	190	190
L1-b	100	*	*	*	*	*	125	125	85	95
L1-c	65	65	85	100	110	110	110	110	75	60
L2	45	45	75	90	100	100	100	100	70	45
L3	40	40	50	50	75	75	75	40	40	40
L4	35	35	40	40	60	60	60	30	30	30
L5	30	30	30	30	55	55	55	25	25	25

Table 3: Modified FFMP with increased L1-c, L2-High, and L2-Low Cannonsville Reservoir releases and no changes for Pepacton and Neversink Reservoirs. Effective date June 1, 2009.

	Winter		Spring		Summer			Fall		
Cannonsville Storage Zone	Dec 1 - Mar 31	Apr 1 - Apr 30	May 1 - May 20	May 21 - May 31	Jun 1 - June 15	Jun 16 - Jun 30	Jul 1 - Aug 31	Sep 1 - Sep 15	Sep 16 - Sep 30	Oct 1 - Nov 30
L1-a	1500	1500	*	*	*	1500	1500	1500	1500	1500
L1-b	250	*	*	*	*	*	350	275	275	250
L1-c	110	110	200	250	325	325	325	275	140	110
L2-High	80	80	190	240	325	325	325	260	115	80
L2-Low	80	80	190	240	300	300	300	260	115	80
L3	70	70	100	100	175	175	175	95	95	70
L4	55	55	75	75	130	130	130	55	55	60
L5	50	50	50	50	120	120	120	50	50	50

	Winter		Spring		Summer			Fall		
Pepacton Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	700	700	*	*	*	700	700	700	700	700
L1-b	185	*	*	*	*	*	250	200	200	185
L1-c	85	85	110	130	150	150	150	150	100	85
L2-H/L	65	65	100	125	140	140	140	140	85	60
L3	55	55	80	80	100	100	100	55	55	55
L4	45	45	50	50	85	85	85	40	40	40
L5	40	40	40	40	80	80	80	30	30	30

	Winter		Spring		Summer			Fall		
Neversink Storage Zone	Dec 1 - 31-Mar	Apr 1 - 30-Apr	May 1 - 20-May	May 21 - 31-May	Jun 1 - 15-Jun	Jun 16 - 30-Jun	Jul 1 - 31-Aug	Sep 1 - 15-Sep	Sep 16 - 30-Sep	Oct 1 - 30-Nov
L1-a	190	190	*	*	*	190	190	190	190	190
L1-b	100	*	*	*	*	*	125	125	85	95
L1-c	65	65	85	100	110	110	110	110	75	60
L2-H/L	45	45	75	90	100	100	100	100	70	45
L3	40	40	50	50	75	75	75	40	40	40
L4	35	35	40	40	60	60	60	30	30	30
L5	30	30	30	30	55	55	55	25	25	25

Table 4: Summary of FFMP thermal, directed, and spill mitigation releases (CFS) from Cannonsville, Pepacton, and Neversink Reservoirs, 2008-11.

				Thermal Releases				Directed Releases				Spill Mitigation Releases			
Cannonsville Reservoir				**Days Made**	**Min Release**	**Max Release**	**Average**	**Days Made**	**Min Release**	**Max Release**	**Average**	**Days Made**	**Min Release**	**Max Release**	**Average**
	2008	Summer	6/1-8/31	3	274	657	458	46	268	989	580				
	2008	Fall	9/1-11/30					38	144	982	640				
	2009	Winter	12/1-2/28												
	2009	Spring	3/1-5/31												
	2009	Summer	6/1-8/31									84	320	1505	916
	2009	Fall	9/1-11/30					18	374	569	464	20	357	855	
	2010	Winter	12/1-2/28									76	173	2116	1055
	2010	Spring	3/1-5/31									60	110	1504	820
	2010	Summer	6/1-8/31	3	514	524	520	46	343	1293	748	16	348	419	410
	2010	Fall	9/1-11/30					26	463	1129	842	91	115	1129	358
	2011	Winter	12/1-2/28									90	195	1505	556
	2011	Spring	3/1-5/31									85	186	1510	975
Pepacton Reservoir															
	2008	Summer	6/1-8/31												
	2008	Fall	9/1-11/30									6	272	285	282
	2009	Winter	12/1-2/28												
	2009	Spring	3/1-5/31												
	2009	Summer	6/1-8/31									84	141	704	358
	2009	Fall	9/1-11/30									6	272	285	283
	2010	Winter	12/1-2/28									89	85	701	486
	2010	Spring	3/1-5/31									60	85	295	128
	2010	Summer	6/1-8/31												
	2010	Fall	9/1-11/30									49	84	88	85
	2011	Winter	12/1-2/28									90	74	206	135
	2011	Spring	3/1-5/31									81	83	702	362
Neversink Reservoir															
	2008	Summer	6/1-8/31												
	2008	Fall	9/1-11/30												
	2009	Winter	12/1-2/28												
	2009	Spring	3/1-5/31												
	2009	Summer	6/1-8/31									84	110	190	129
	2009	Fall	9/1-11/30												
	2010	Winter	12/1-2/28									79	65	203	144
	2010	Spring	3/1-5/31									58	65	101	85
	2010	Summer	6/1-8/31												
	2010	Fall	9/1-11/30									49	60	63	60
	2011	Winter	12/1-2/28									90	65	190	93
	2011	Spring	3/1-5/31									92	63	190	111

Table 5: Thermal Stress Days*and maximum water temperatures recorded at monitoring sites on the Delaware River, West Branch, East Branch, and Neversink River Tailwaters, 2008-2010.

Station	miles below dam	2008		2009		2010	
Mainstem Delaware		**Days**	**Max Temp**	**Days**	**Max Temp**	**Days**	**Max Temp**
Leonards	21.1	8	78.0	0	71.8	10	77.3
USGS @ Lordville	27.5	18	81.1	0	73.6	25	80.8
Abe Lord	28.7	20	81.5	0	73.2	24	81.5
Kellams Bridge	36.6	23	81.8	0	74.6	42	82.9
USGS @ Callicoon	46.2	45	84.7	4	78.3	58	86.7
West Br Delaware							
USGS @ Stilesville	1.4	0	56.3	0	71.4	0	63.1
Stilesville	1.7	0	55.3	0	58.4	0	62.2
Men's Club	4.7	0	64.9	0	62.9	0	0.0
Hale Eddy near USGS	8.6	0	68.3	0	64.9	0	67.0
USGS @ Hale Eddy	8.6	0	68.4	0	65.8	0	66.7
Roods Ck	10.3	0	69.0	0	66.3	0	67.7
Balls Eddy	13.6	0	71.8	0	67.0	0	71.1
Hancock near USGS	17.0	0	73.2	0	67.7	0	72.5
USGS @ Hancock	17.0	0	73.6	0	68.4	0	73.9
Shehawken	17.9	0	73.8	0	68.3	0	73.2
East Br Delaware							
Downsville	2.2	0	59.4	0	59.4	0	62.9
Shinhopple	8.2	0	63.9	0	61.5	0	62.9
Terry's Campsite	11.0	0	67.7	0	64.9	0	69.0
Deutch's Flat	12.4	0	69.8	0	64.9	0	69.7
Harvard near USGS	14.3	0	71.8	0	66.3		
USGS @ Harvard	14.3	0	72.3	0	67.5	0	73.0
EastBranch	17.0	0	73.2	0	66.3	0	73.2
USGS @ Fishes Eddy	21.6	21	79.9	0	72.7	35	81.0
Hancock(Fireman's Park)	31.2	35	82.2	0	74.5	62	85.8
Neversink							
Hasbrouck	2.8	0	65.0	0	70.8	0	61.9
Woodbourne	6.0	0	65.7	0	71.6	0	65.4
Just abv Fallsburg	8.4	0	66.6	0	71.9	0	66.0
Ranch Rd. bridge	11.9	0	73.2	0	72.5	0	74.5
USGS @ Bridgeville	16.2	2	76.6	0	72.5	9	77.7

*Stress days are defined as any day the highest water temperature at the site was equal to or greater than 75F or the average temperature was equal to or greater than 72F over a 24 h period. In most cases, both events were true.

Table 6: Summary of trout abundance (trout/acre) and biomass (lbs/acre) at four sites on the West Branch, four sites on the East Branch, and three sites on the Neversink River, 2008-10. Figures in parentheses are 95% confidence intervals.

TROUT DENSITY (FISH/ACRE)

	Miles Below Dam	2008	2009	2010
West Branch				
Stilesville	2.1		120.7 (86.7-154.7)	192.8 (150.3-235.3)
No Kill	3.9		50.4 (25.7-75.1)	76.8 (51.6-102.0)
Hale Eddy	7.9		187.3 (98.0-276.6)	79.4 (54.9-103.9)
Balls Eddy	12.7		19.1 (0-38.8)	**30[1]**
East Branch				
Airport	4.2	58.8 (39.3-78.3)	59.5 (44.7-74.3)	106.2 (82.9-129.5)
T28	6.3	234.5 (181.0-288.0)	216.9 (146.5-287.3)	412.7 (274.7-550.7)
Cabin	9.9	78.5 (49.2-107.8)	122.8 (99.8-145.8)	245.4 (136.9-353.9)
T22	14.9	11.1 (3.7-18.5)	21.2 (3.7-38.7)	15.9 (8.5-23.3)
Neversink River				
Hasbrouck	2.8	45.2 (20.2-70.2)	131.0 (23.9-238.1)	44.4 (13.4-75.4)
Fallsburg	8.0	54.8 (11.7-97.9)	76.0 (22.6-129.4)	55.5 (26.0-85.0)
Ranch Road	12.9	165.3 (105.3-225.3)	272.9 (178.9-366.9)	336.7 (216.7-456.7)

TROUT BIOMASS (LBS/ACRE)

West Branch				
Stilesville	2.1		68.2	88.6
No Kill	3.9		29.4	65.3
Hale Eddy	7.9		74.1	50.3
Balls Eddy	12.7		23.7	25.4
East Branch				
Airport	4.2	6.2	11.5	17.3
T28	6.3	19.5	20.4	49.0
Cabin	9.9	15.6	24.3	30.9
T22	14.9	7.0	17.2	12.1
Neversink River				
Hasbrouck	2.8	26.7	42.2	41.1
Fallsburg	8.0	23.7	19.4	18.6
Ranch Road	12.9	99.7	117.9	141.2

[1]Based on electrofishing efficiency since the estimate with one recapture was way to high to be believable.

Table 7: Summary of trout abundance (trout/acre) and biomass (lbs/acre) at four sites on the West Branch, four sites on the East Branch, and three sites on the Neversink River, 1992-2010.

Fish/acre

	Miles Below Dam	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
WEST BRANCH																					
Stilesville	***2.1***		75	29	41	***7***		73	191	172	121	129		76	67	158	236		121	193	113
Celotex	***3.9***		51	53	30	132		46	68		30	44		28	21	60	16		50	77	50
Hale Eddy	***7.9***		76	90	39	17		58	40		97	***21***		38	27	48	61		187	79	63
Balls Eddy	***12.7***		38	**13**	36	26		16	81	41	69	55		53	**11**	51	31		19	**30**	38
EAST BRANCH																					
Airport Pool	***4.2***		151	204	311	529						510		105	51	58	56	56	60	106	183
T28 Pool	***6.3***													143	154	49	173	235	217	413	198
Cabin Pool	***9.9***													37	89	160	102	79	123	245	119
T22 Pool	***14.9***													**11**	**16**	**5**	**25**	11	21	16	15
NEVERSINK RIVER																					
Hasbrouck	***2.8***	405			74	55	69	28	32					228	26	45	60	45	131	44	96
Fallsburg	***8.0***				43	34	41	14	4					130	23	29	58	55	76	56	47
Ranch Road	***12.9***		43		37	26	25	18	55					339	176	195	307	165	273	337	154

Pounds/acre

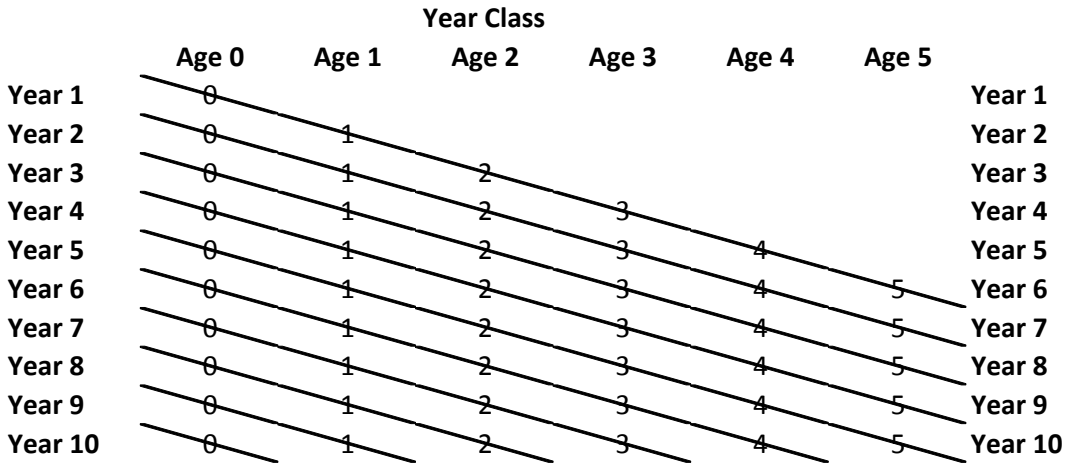
	Miles Below Dam	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average
WEST BRANCH																					
Stilesville	***2.1***		44.7	19.7	27.4	***4.7***		60.4	129.8	102.7	62.4	54.2		62.7	50.7	166.1	148.1		68.2	88.6	72.7
Celotex	***3.9***		33.1	40.9	25.1	113.7		48.9	47.3		36.3	39.4		39.9	32.9	69.4	21.0		29.4	65.3	45.9
Hale Eddy	***7.9***		34.1	44.5	26.8	9.6		18.9	17.4		36.5	***14.5***		23.9	21.7	59.1	43.6		74.1	50.3	33.9
Balls Eddy	***12.7***		25.6	**6.2**	22.4	15.4		7.8	45.3	24.0	37.5	28.3		36.1	**11.6**	47.7	27.4		23.7	**25.4**	25.6
EAST BRANCH																					
Airport Pool	***4.2***		26.2	28.7	44.7	38.2						67.4		27.0	14.3	62.0	26.4	6.2	11.5	17.3	30.8
T28 Pool	***6.3***													51.9	25.5	15.3	105.5	19.5	20.4	49.0	41.0
Cabin Pool	***9.9***													30.2	63.6	81.4	46.3	15.6	24.3	30.9	41.8
T22 Pool	***14.9***													**13.4**	**16.9**	**0.4**	**21.6**	7.0	17.2	12.1	12.7
NEVERSINK RIVER																					
Hasbrouck	***2.8***	89.0			16.2	28.1	48.4	29.0	4.4					134.1	14.8	31.9	22.7	26.7	42.2	41.1	40.7
Fallsburg	***8.0***		39.1		25.9	10.2	26.1	3.7	0.7					81.3	15.7	14.9	21.6	23.7	19.4	18.6	23.1
Ranch Road	***12.9***				29.6	8.6	18.5	5.4	44.3					110.2	99.8	105.9	145.3	99.7	117.9	141.2	77.2

Note: Figures in bold but not underlined were sampling efforts that resulted in no recaptures. Figures in bold and underlined were sampling efforts in which only the marking run was completed. Electrofishing efficiencies were used to estimate trout abundance.

Table 8: Size and percentage distribution of 12 in and larger trout collected from the West Branch, East Branch, and Neversink River for each study site from 2008-2010.

	Year	Total Trout	≥ 12 in N (%)	≥ 16 in N (%)	≥ 20 in N (%)
West Branch					
Stilesville	2009	351	95 (27)	61 (17)	5 (1)
No Kill	2009	208	48 (23)	39 (19)	7 (3)
Hale Eddy	2009	409	63 (15)	37 (9)	7 (2)
Balls Eddy	2009	36	20 (56)	15 (42)	2 (6)
Totals		**1004**	**226 (23)**	**152 (15)**	**12 (2)**
Stilesville	2010	549	131 (24)	59 (11)	4 (1)
No Kill	2010	401	182 (45)	95 (24)	10 (2)
Hale Eddy	2010	358	104 (29)	53 (15)	13 (4)
Balls Eddy	2010	105	49 (47)	17 (16)	1 (1)
Totals		**1413**	**466 (33)**	**224 (16)**	**28 (2)**
East Branch					
Airport Pool	2008	83	2 (2)	1 (1)	0
T28 Pool	2008	180	2 (1)	1 (1)	1 (1)
Cabin Pool	2008	142	6 (4)	5 (4)	3 (2)
T22 Pool	2008	12	4 (33)	1 (8)	1 (8)
Totals		**417**	**14 (3)**	**8 (2)**	**5 (1)**
Airport Pool	2009	95	3 (3)	2 (2)	0
T28 Pool	2009	136	1 (1)	1 (1)	0
Cabin Pool	2009	186	5 (3)	3 (2)	2 (1)
T22 Pool	2009	18	6 (33)	4 (22)	1 (6)
Totals		**435**	**15 (3)**	**10 (2)**	**3 (1)**
Airport Pool	2010	161	5 (3)	2 (1)	2 (1)
T28 Pool	2010	207	4 (2)	4 (2)	2 (1)
Cabin Pool	2010	248	7 (3)	1 (<1)	0
T22 Pool	2010	19	8 (42)	3 (6)	0
Totals		**635**	**24 (4)**	**10 (2)**	**4 (1)**
Neversink River					
Hasbrouck	2008	22	6(27)	4(18)	1(5)
Fallsburg	2008	28	6(21)	4(14)	0
Ranch Road	2008	49	14(29)	4(8)	0
Totals		**99**	**26(26)**	**12(12)**	**1(1)**
Hasbrouck	2009	33	5(15)	2(6)	0
Fallsburg	2009	38	4(11)	1(3)	0
Ranch Road	2009	74	15(20)	4(5)	0
Totals		**145**	**24(17)**	**7(5)**	**0**
Hasbrouck	2010	18	8(44)	6(33)	0
Fallsburg	2010	37	15(20)	4(5)	0
Ranch Road	2010	86	21(24)	2(2)	0
Totals		**141**	**44(31)**	**12(9)**	**0**

Table 9: Comparison of study year and year class presence.



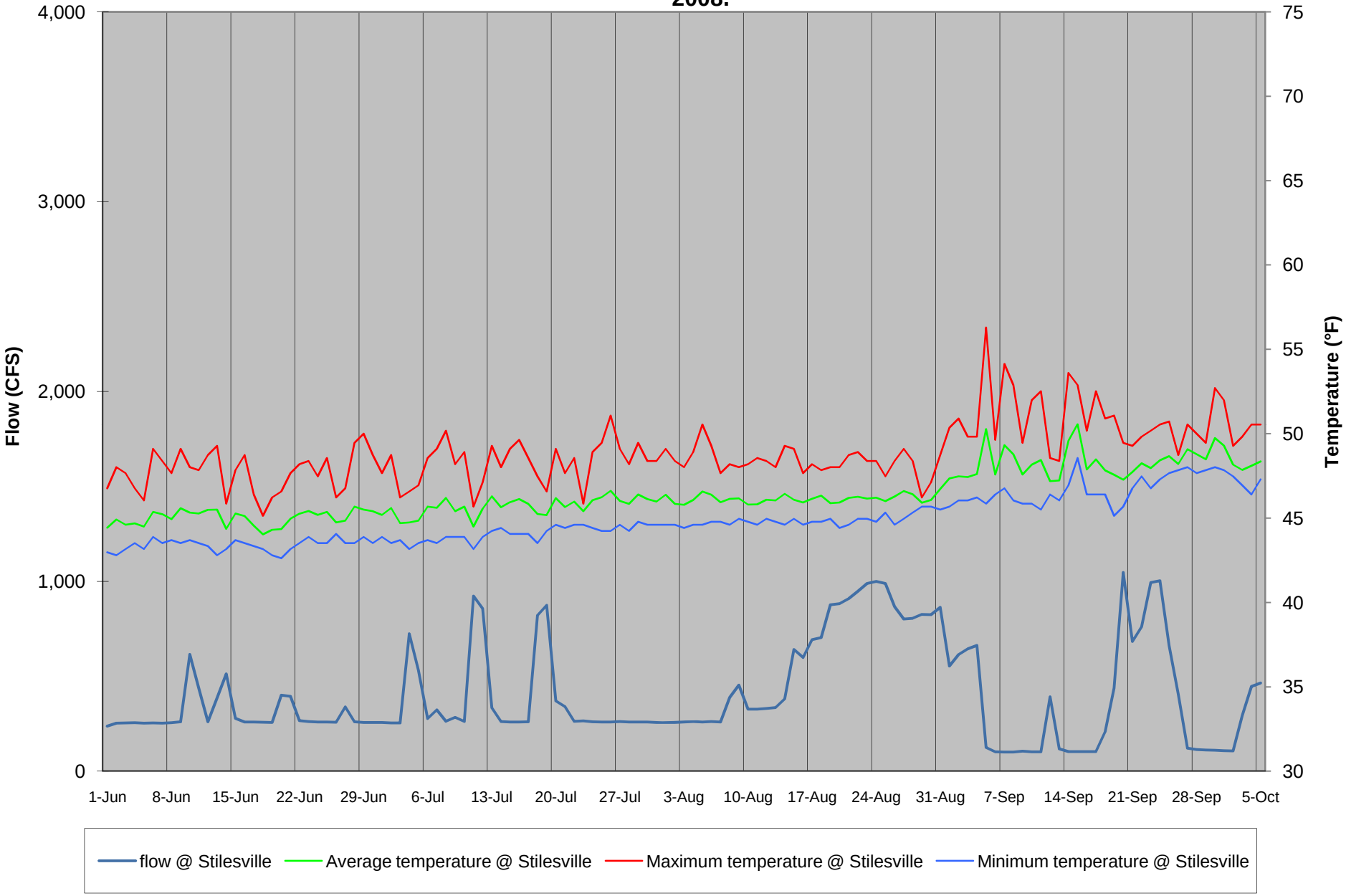
Appendix 1:

UPPER DELAWARE TAILWATERS

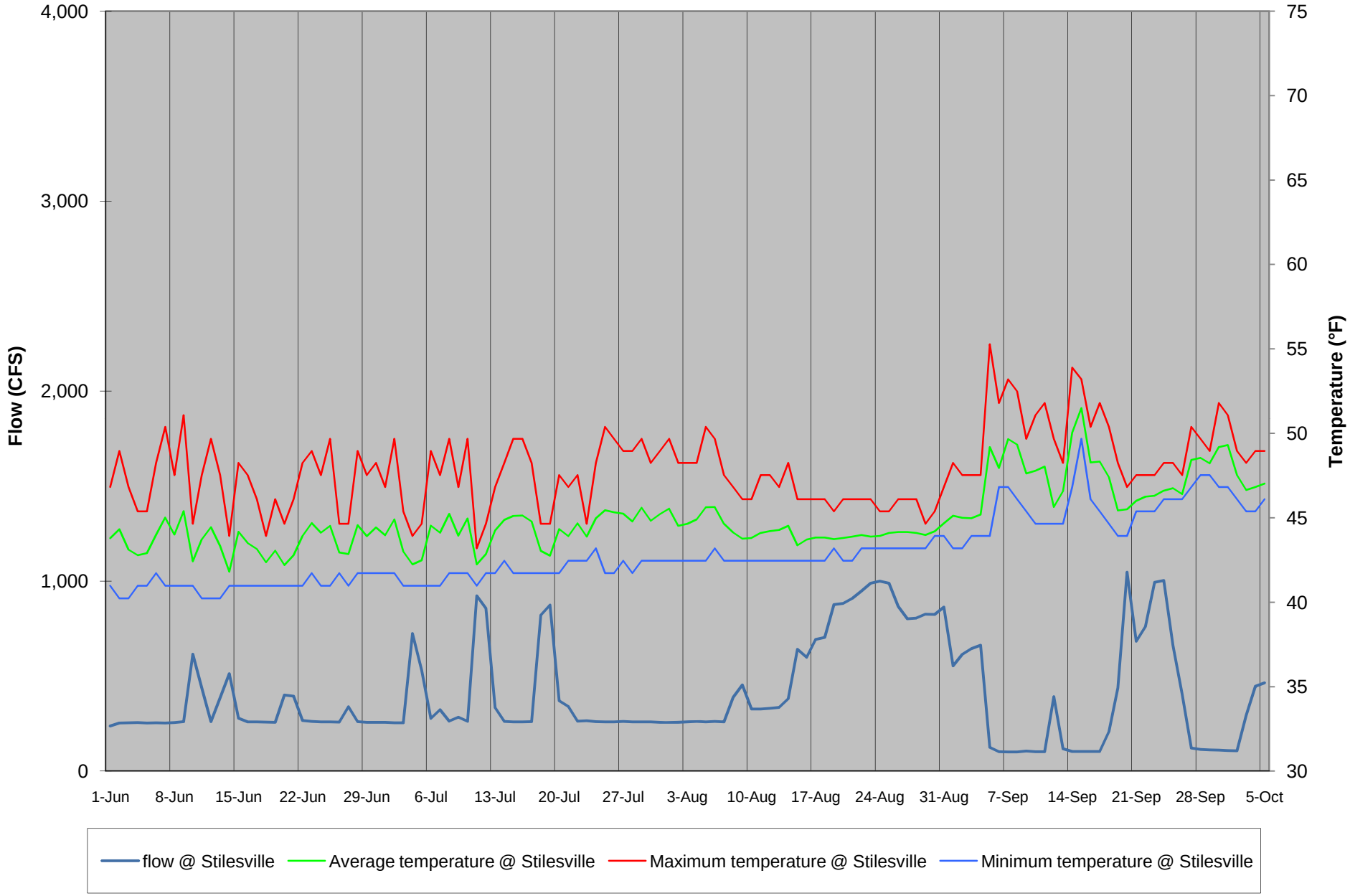
Maxima, minima, and average summer water temperature profile for each temperature monitoring site, 2008

West Branch: Appendices 1A to 1J
East Branch: Appendices 1K to 1S
Neversink River: Appendices 1T to 1X
Delaware River: Appendices 1Y to 1CC

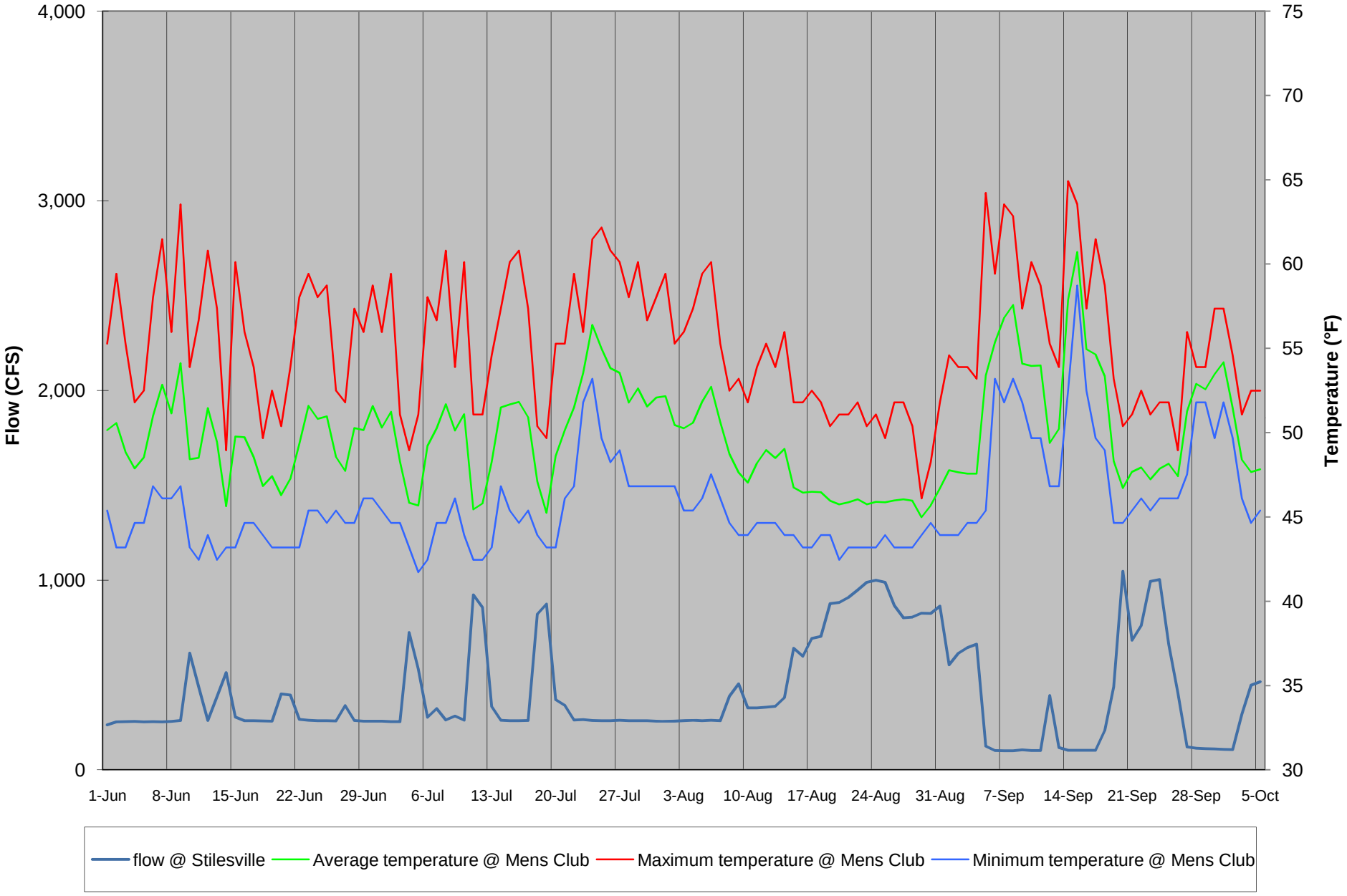
Appendix 1A. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the West Branch at Stilesville, along with daily average flows at Stilesville, 2008.



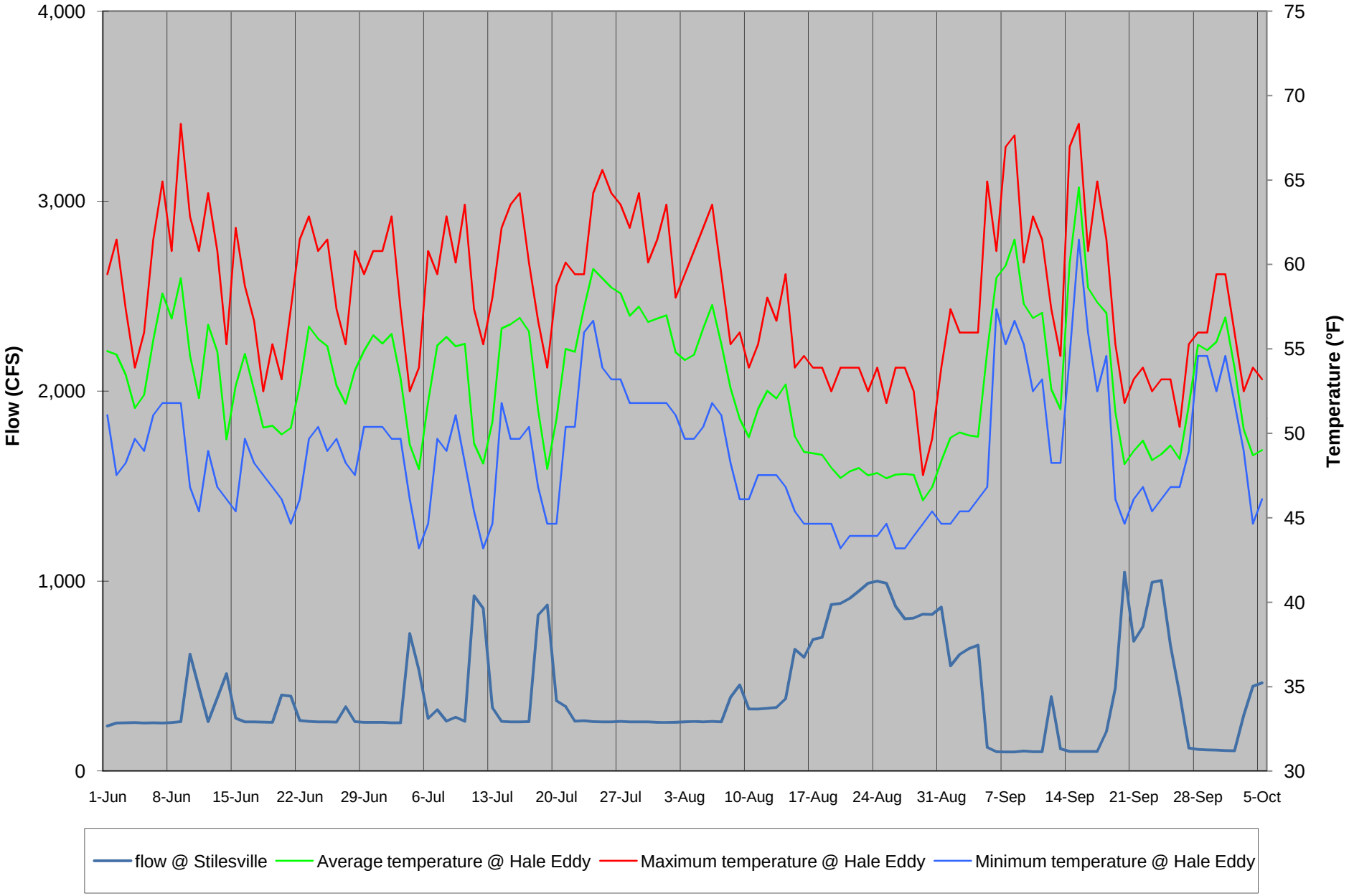
Appendix 1B. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Stilesville, along with daily average flows at Stilesville, 2008.



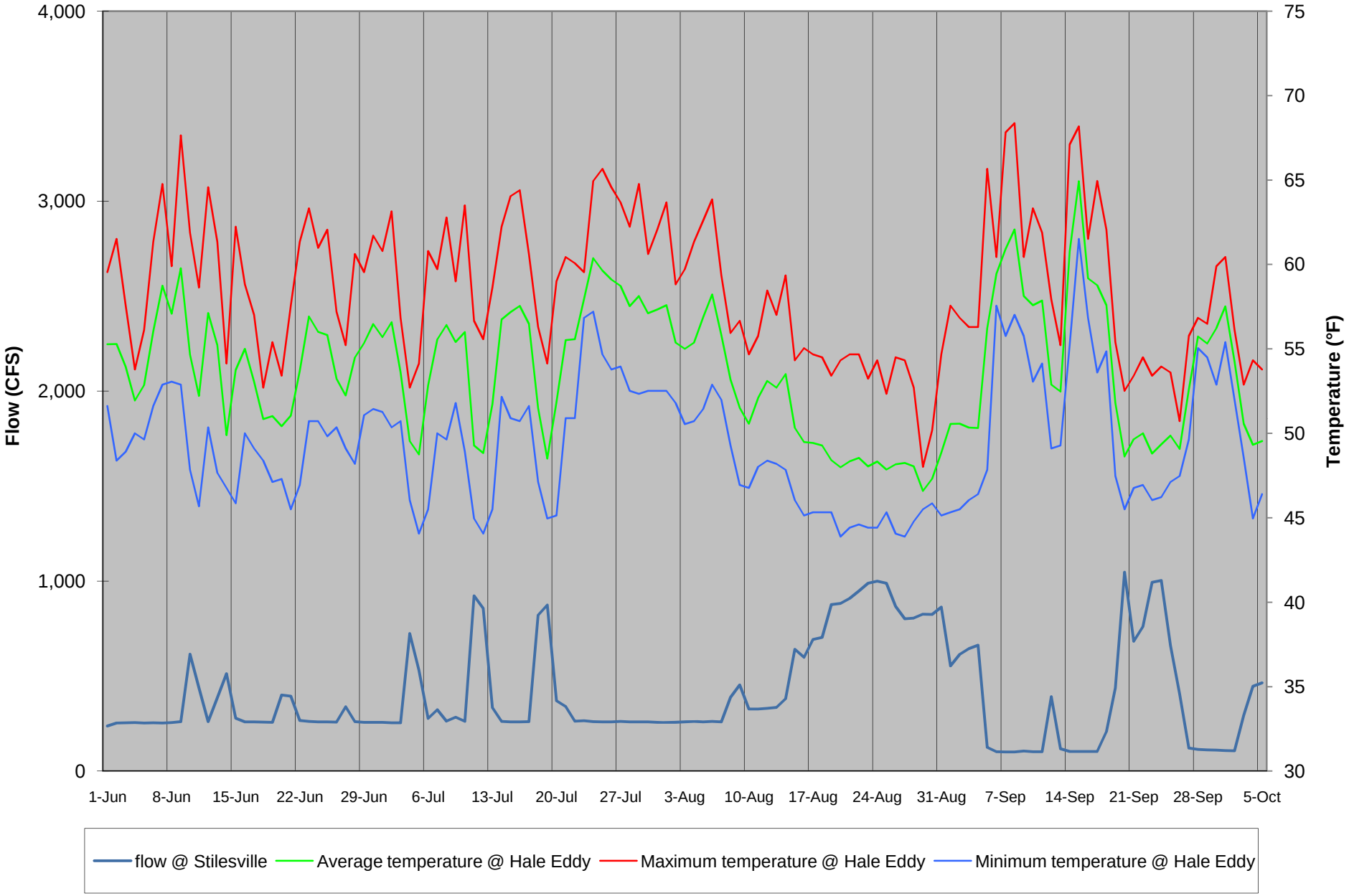
Appendix 1C. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Mens Club, along with daily average flows at Stilesville, 2008.



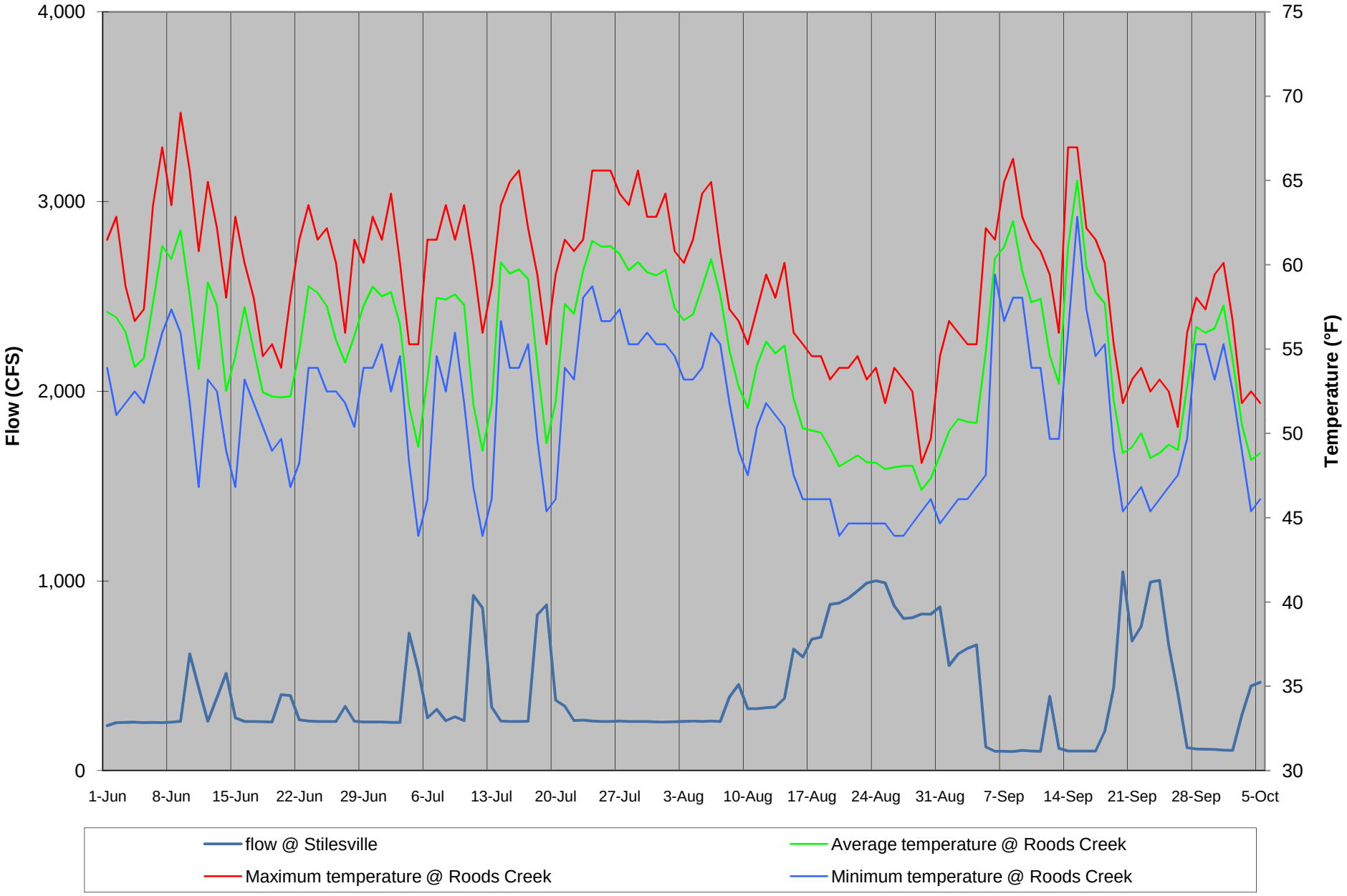
Appendix 1D. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Hale Eddy, along with daily average flows at Stilesville, 2008.



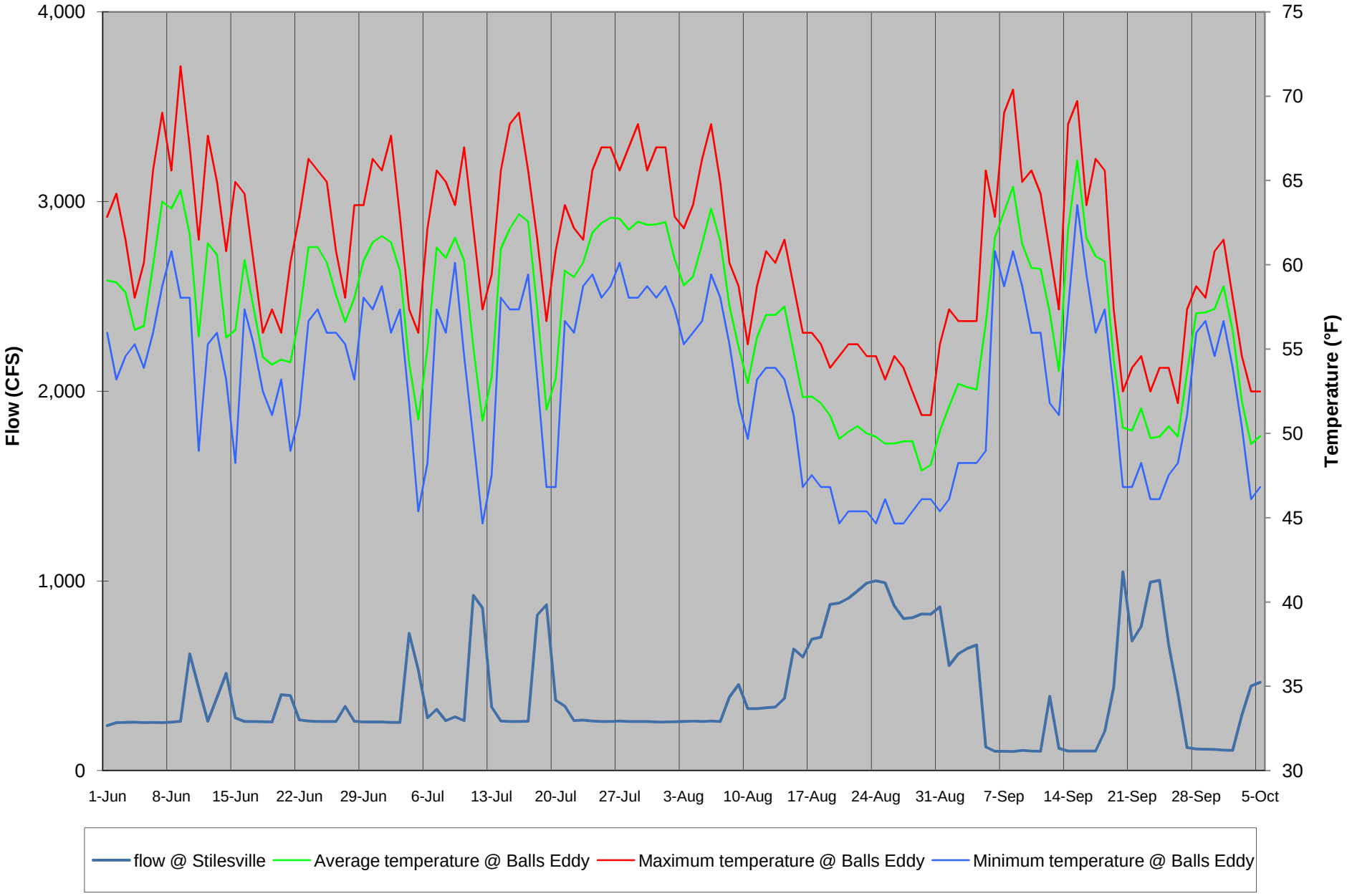
Appendix 1E. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the West Branch at Hale Eddy, along with daily average flows at Stilesville, 2008.



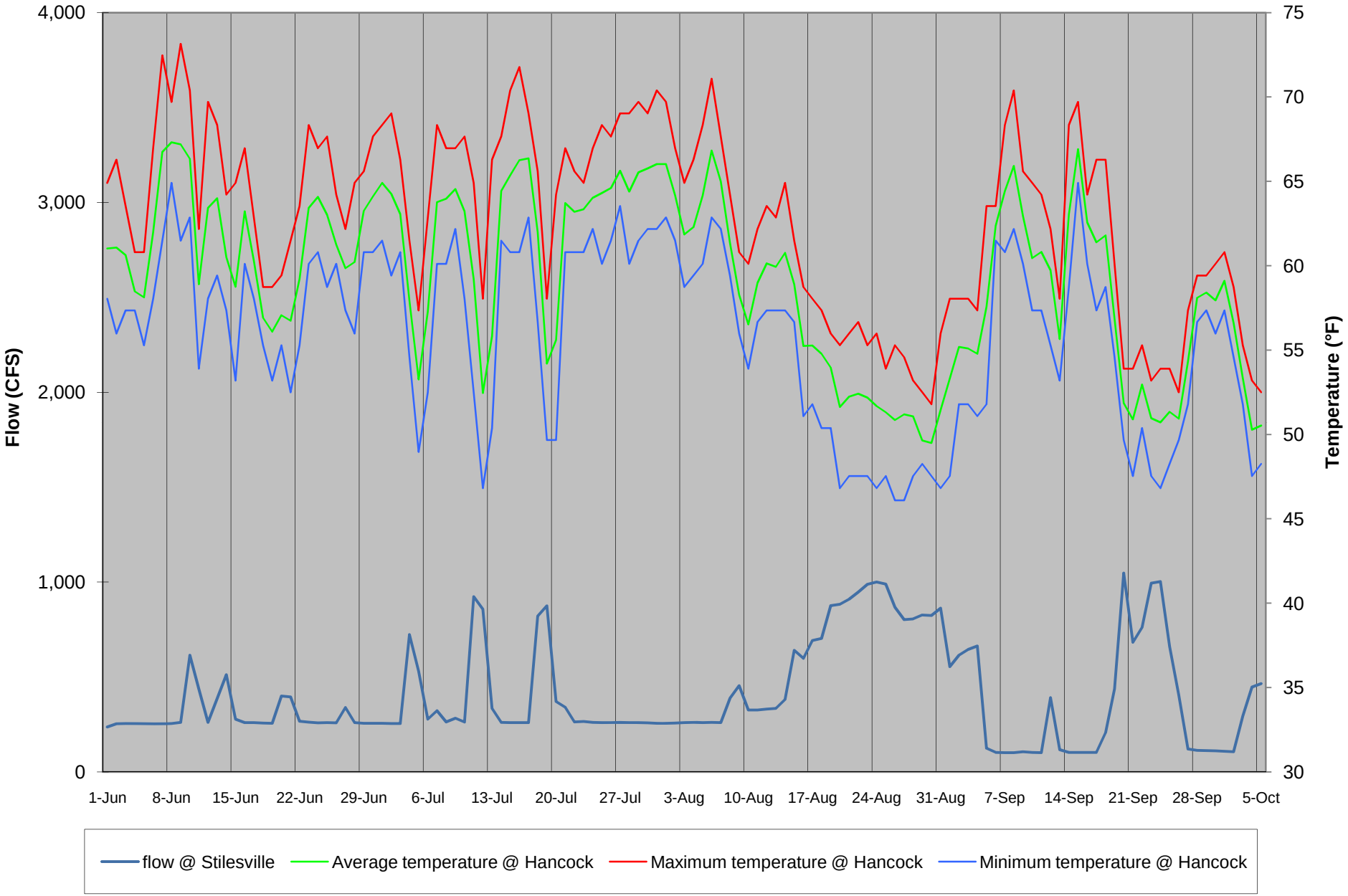
Appendix 1F. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Roods Creek, along with daily average flows at Stilesville, 2008.



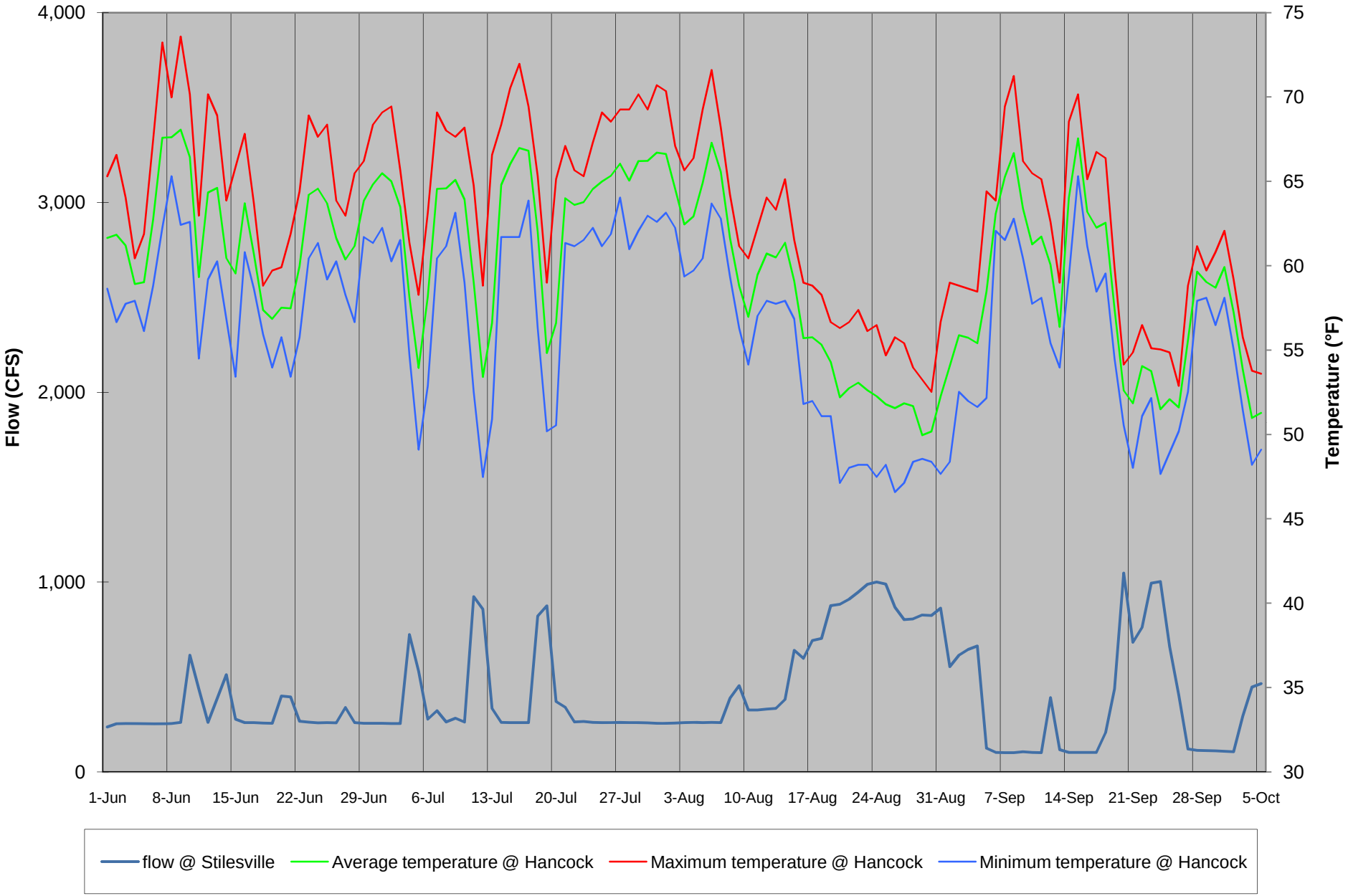
Appendix 1G. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Balls Eddy, along with daily average flows at Stilesville, 2008.



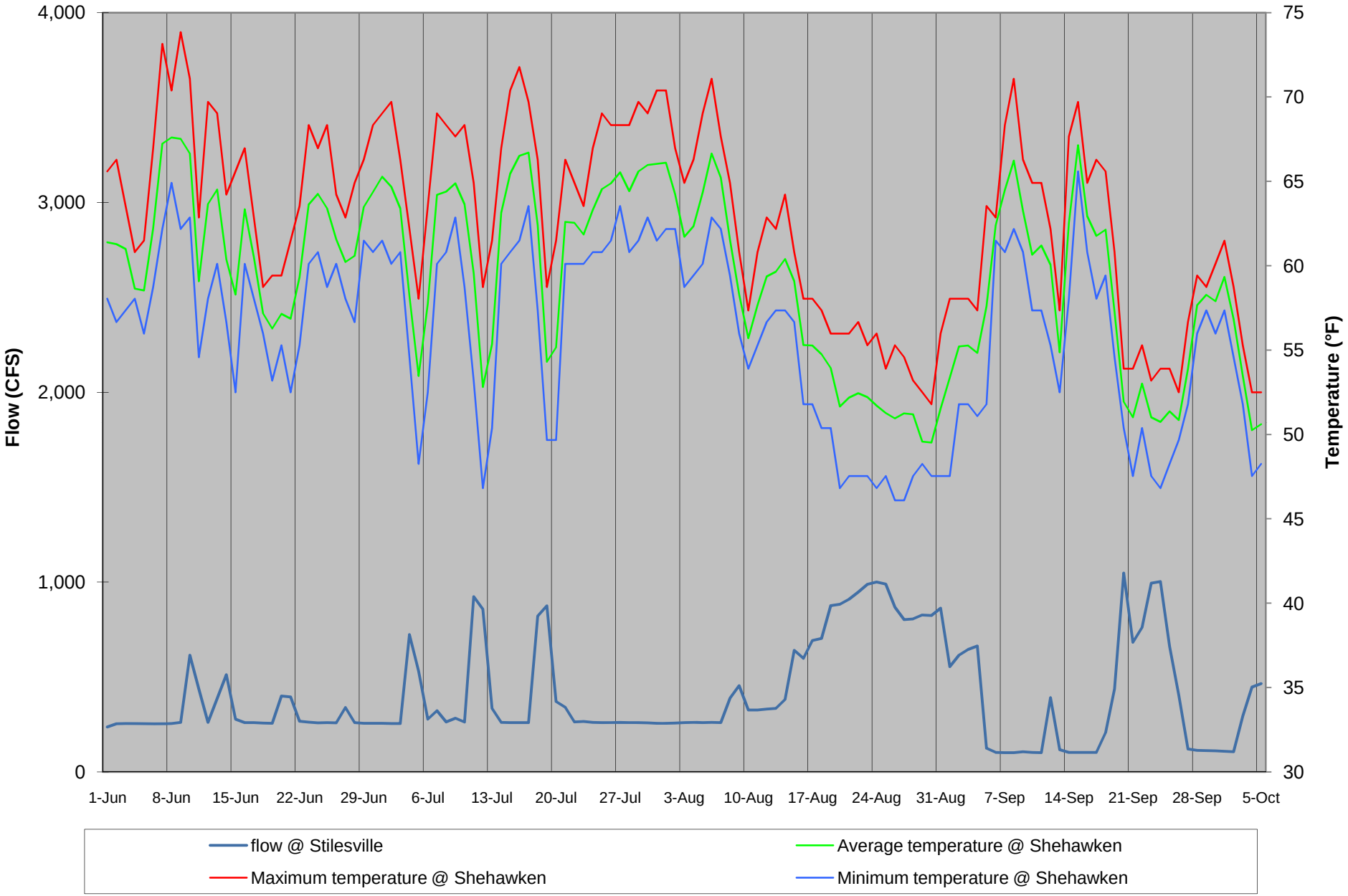
Appendix 1H. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Hancock, along with daily average flows at Stilesville, 2008.



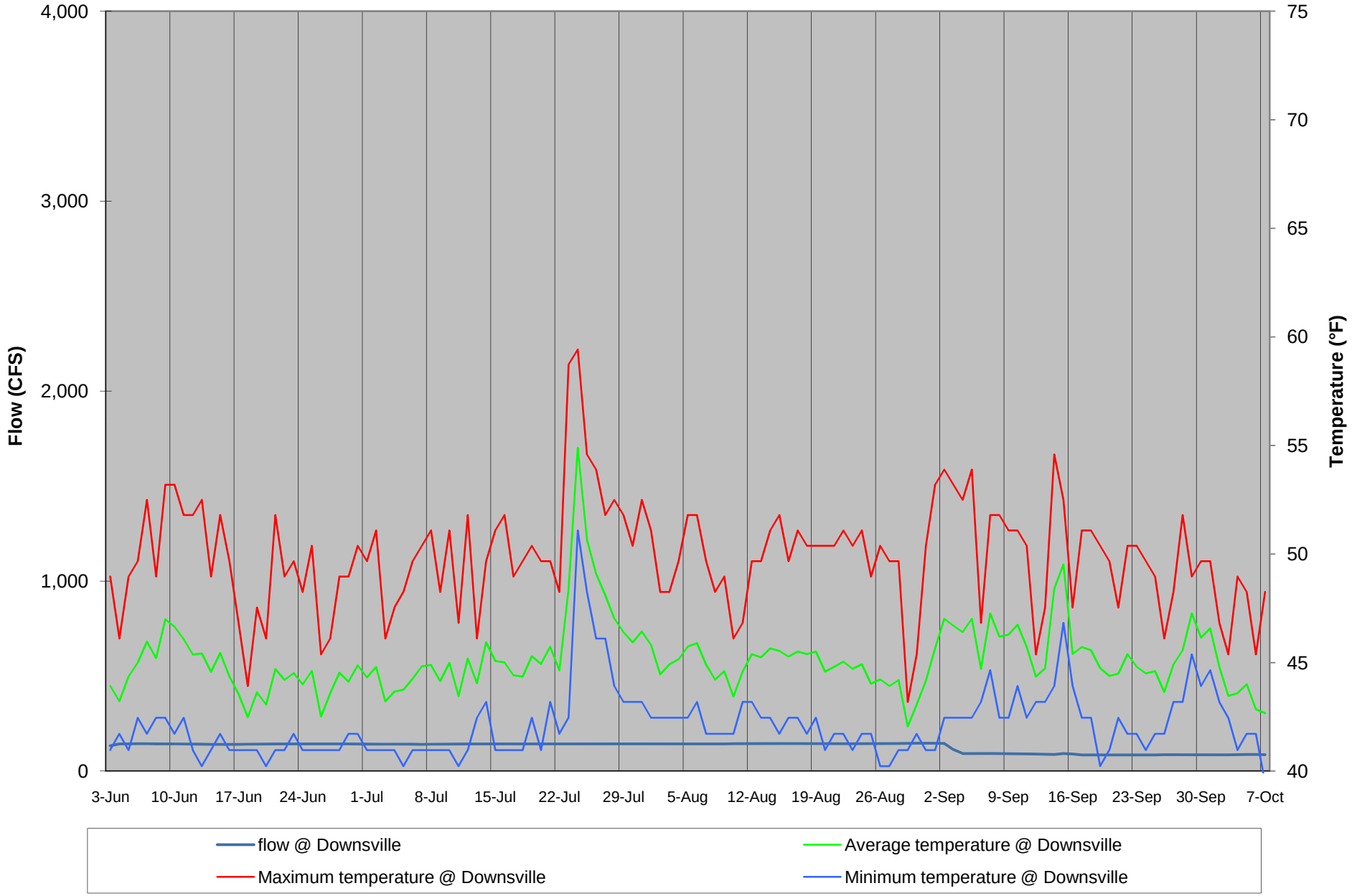
Appendix 1I. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the West Branch at Hancock, along with daily average flows at Stilesville, 2008.



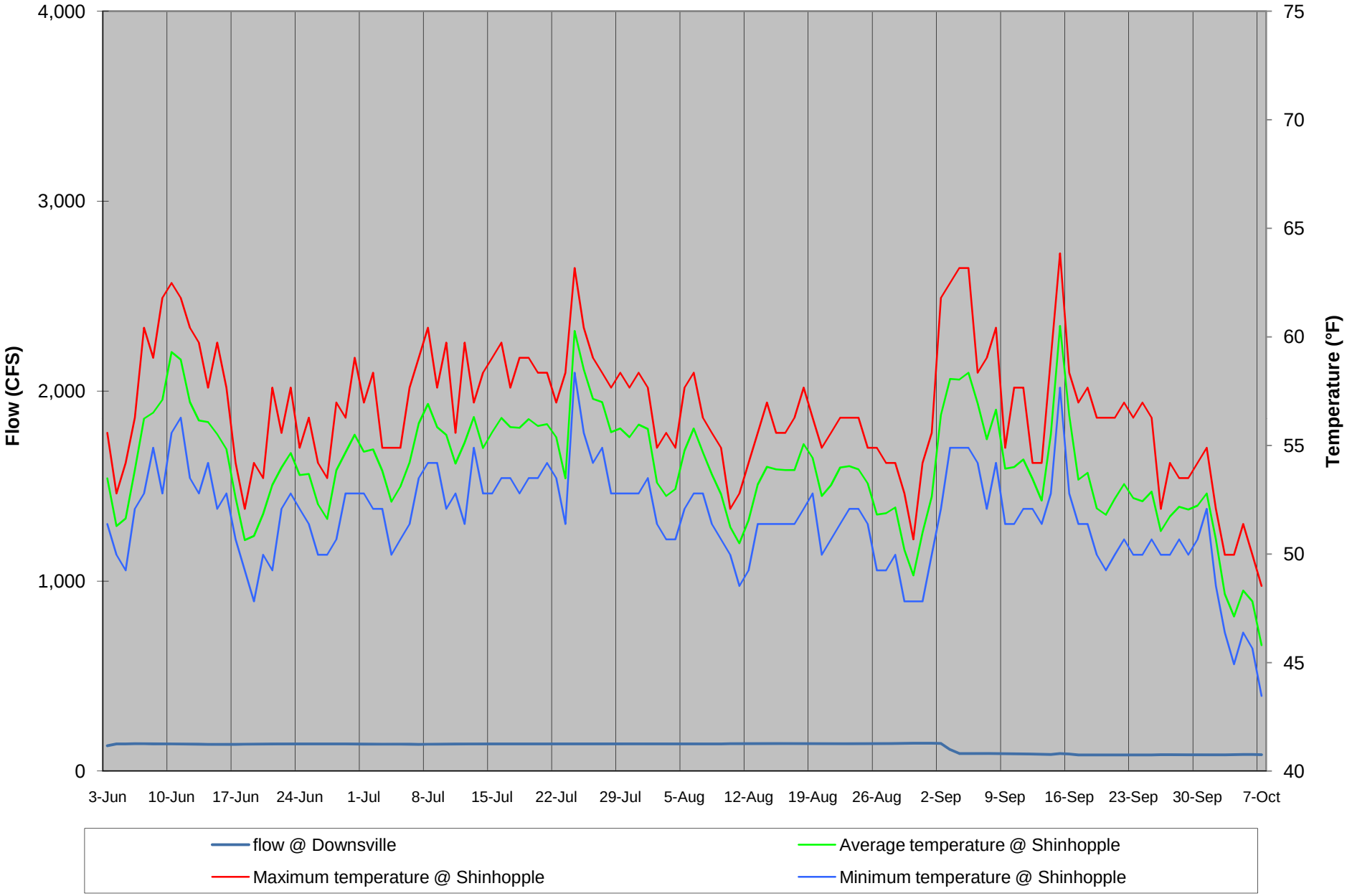
Appendix 1J. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Shehawken, along with daily average flows at Stilesville, 2008.



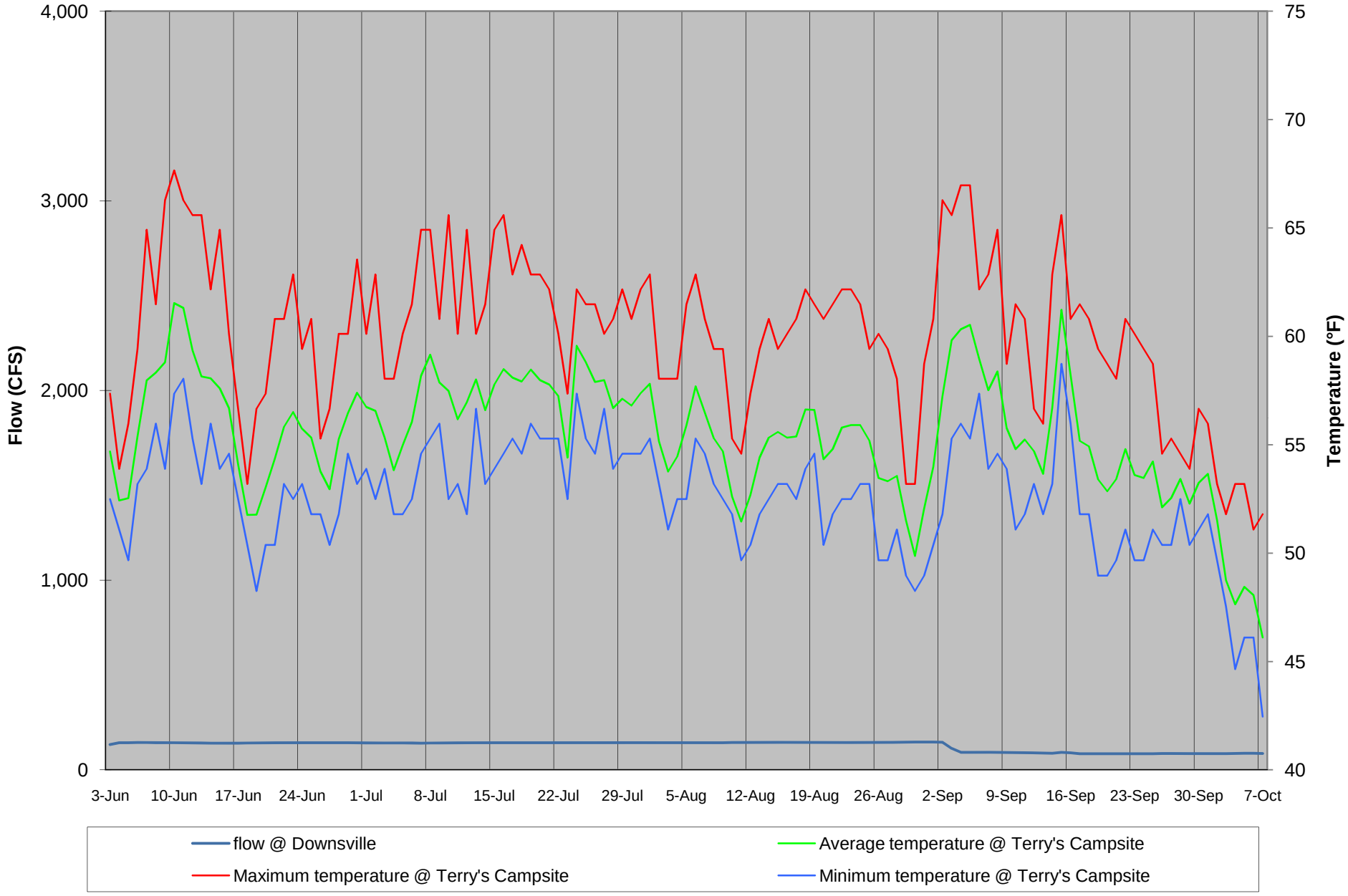
Appendix 1K. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Downsville, along with daily average flows at Downsville, 2008.



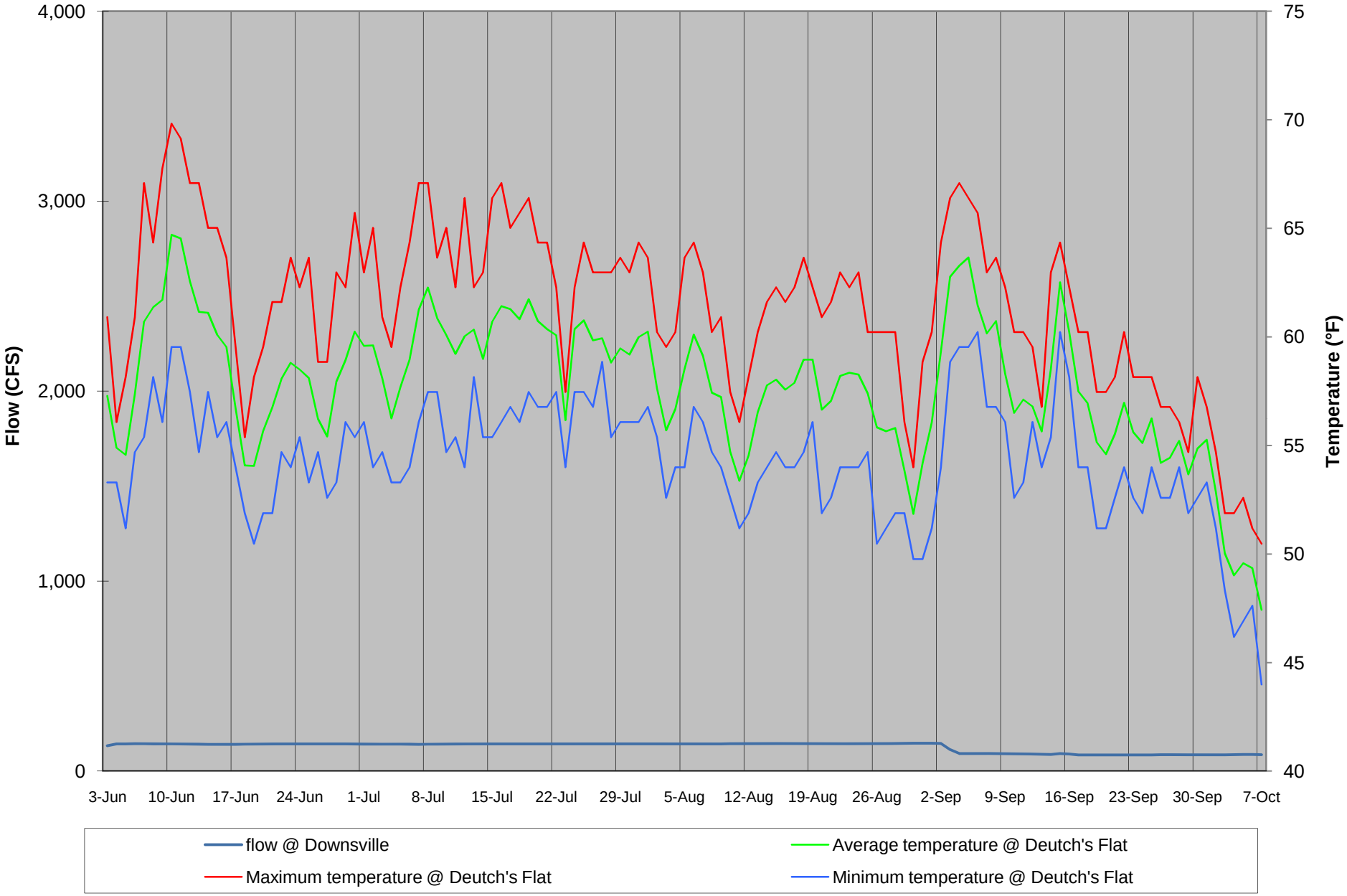
Appendix 1L. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Shinhopple, along with daily average flows at Downsville, 2008.



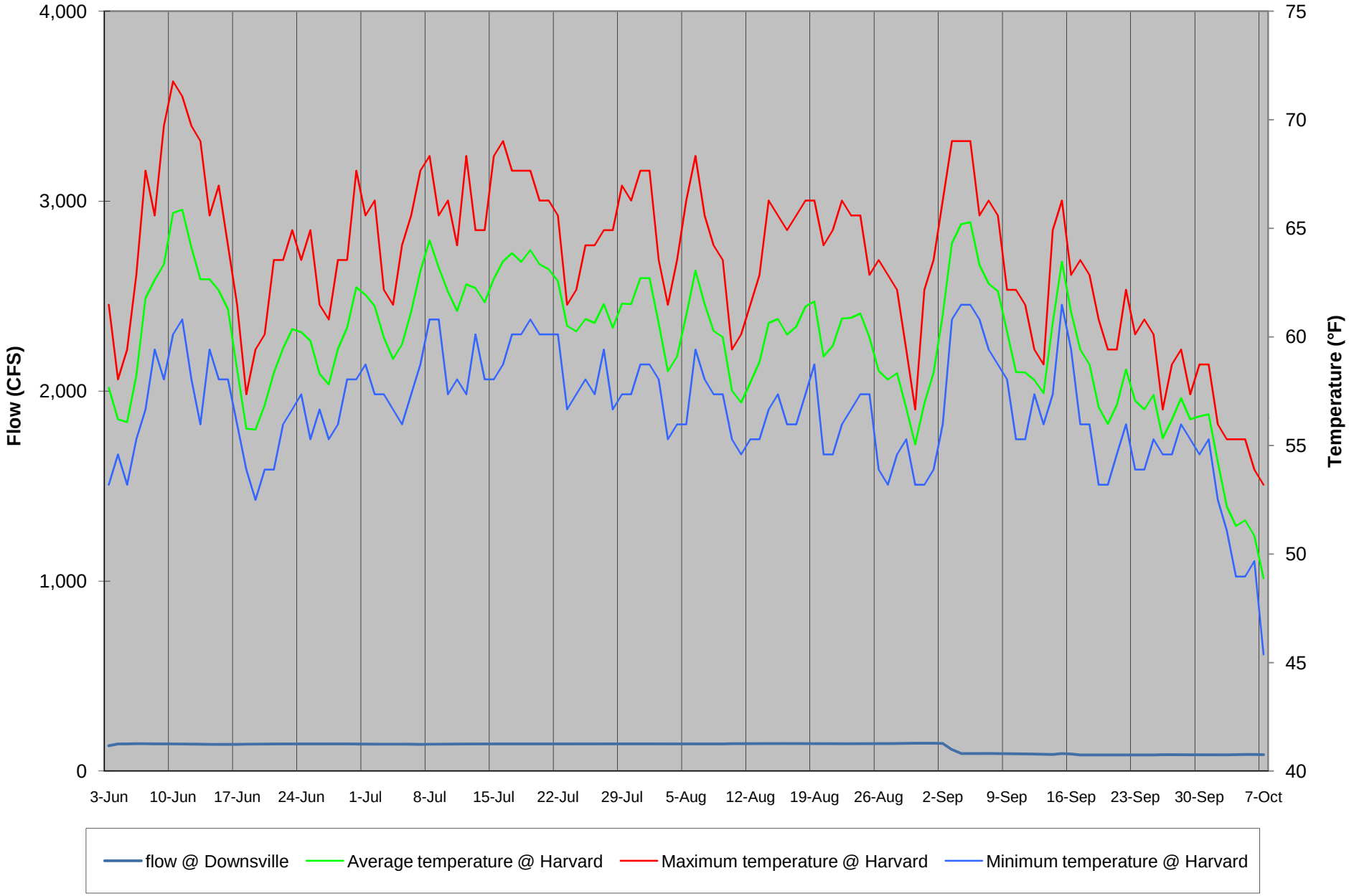
Appendix 1M. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Terry's Campsite, along with daily average flows at Downsville, 2008.



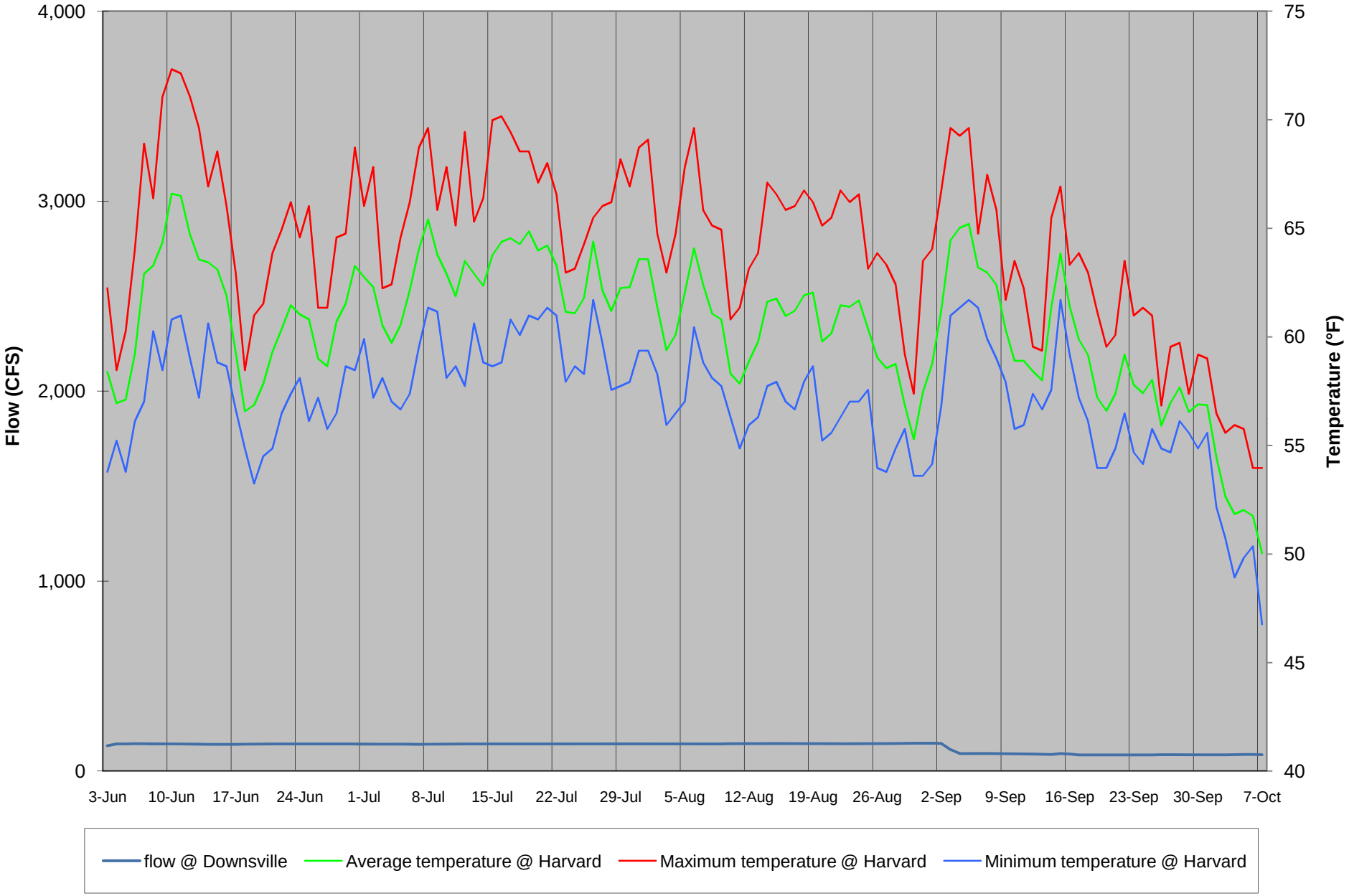
Appendix 1N. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Deutch's Flat, along with daily average flows at Downsville, 2008.



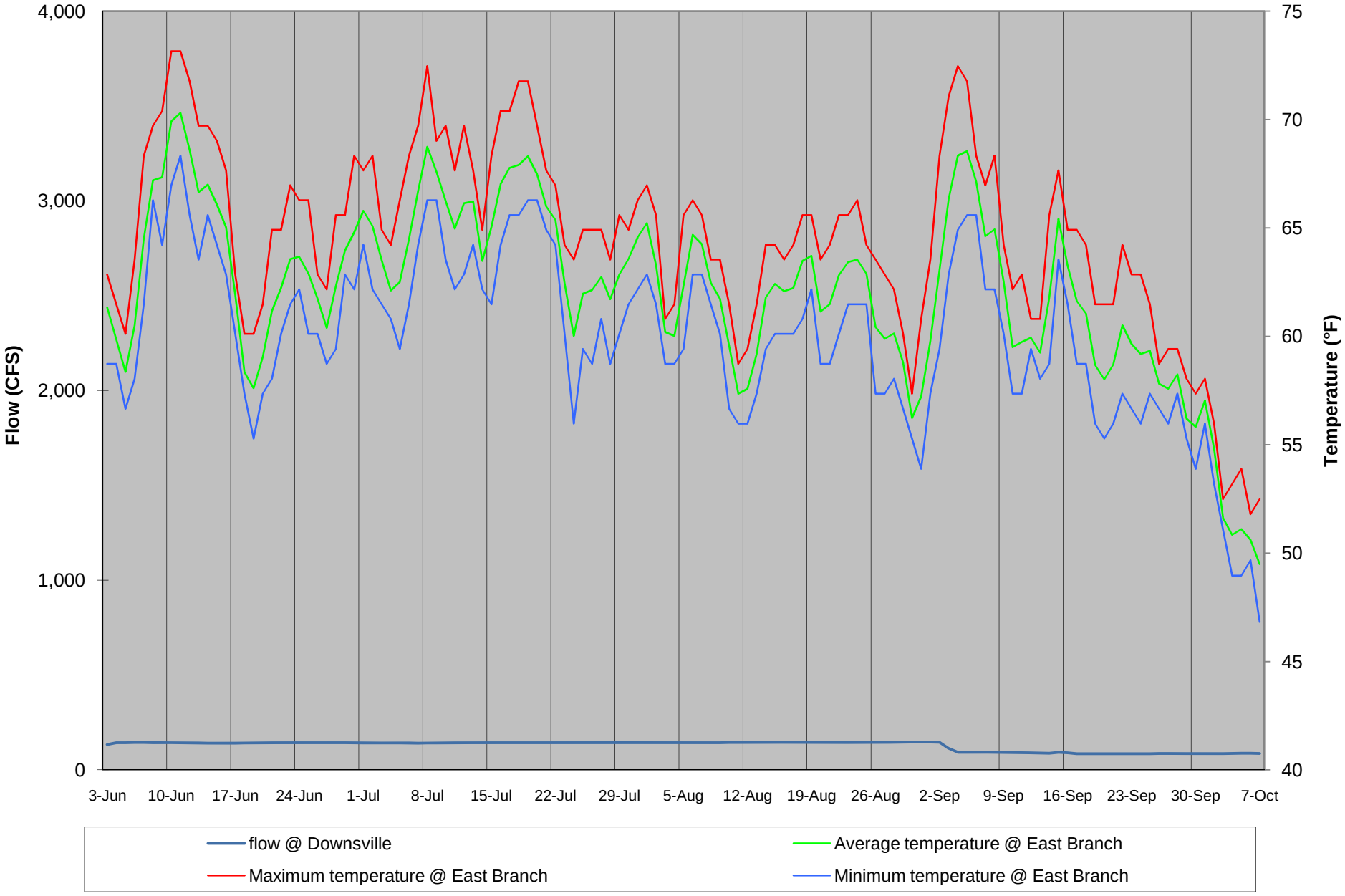
Appendix 1O. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Harvard, along with daily average flows at Downsville, 2008.



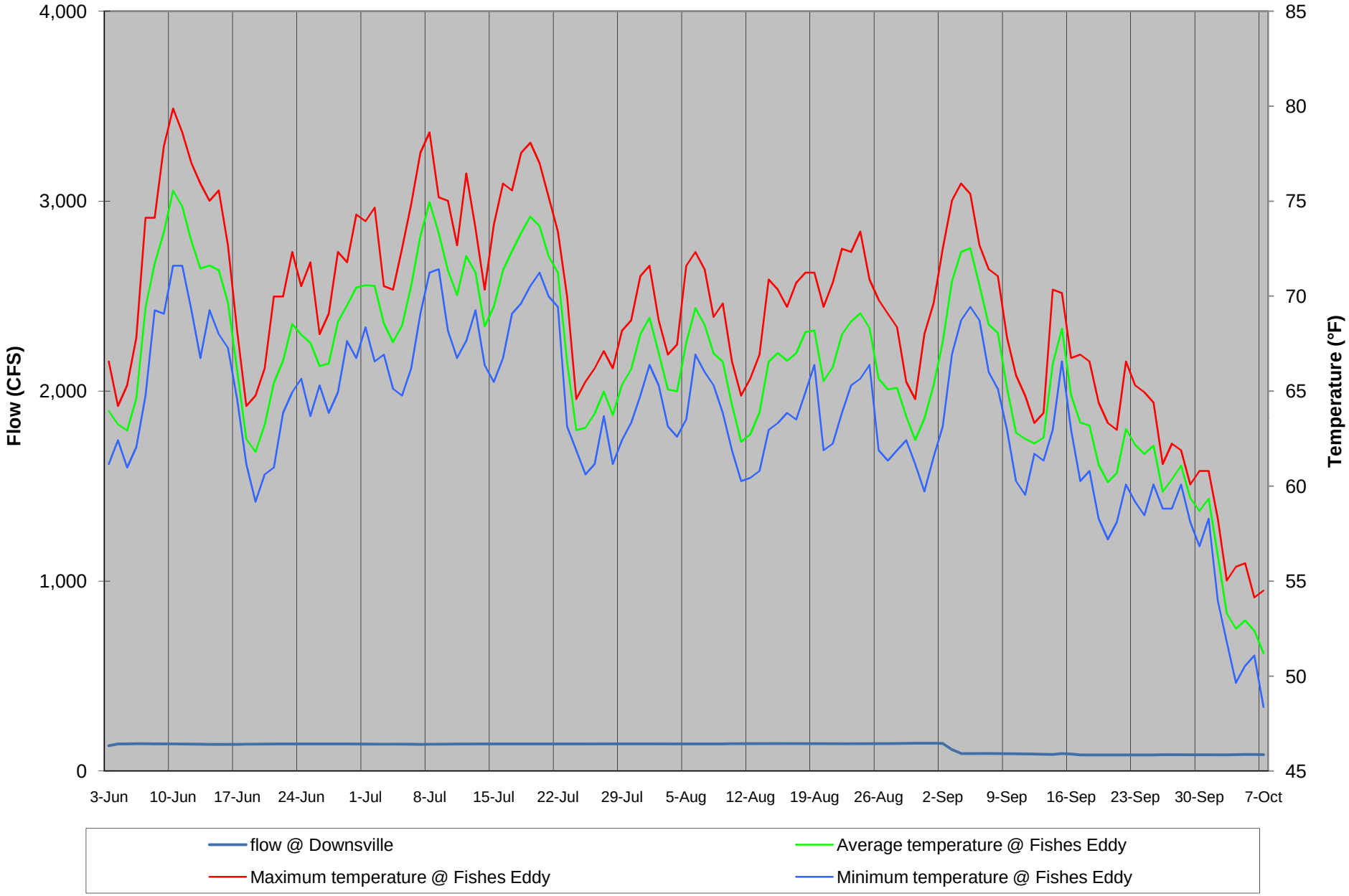
Appendix 1P. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the East Branch at Harvard, along with daily average flows at Downsville, 2008.



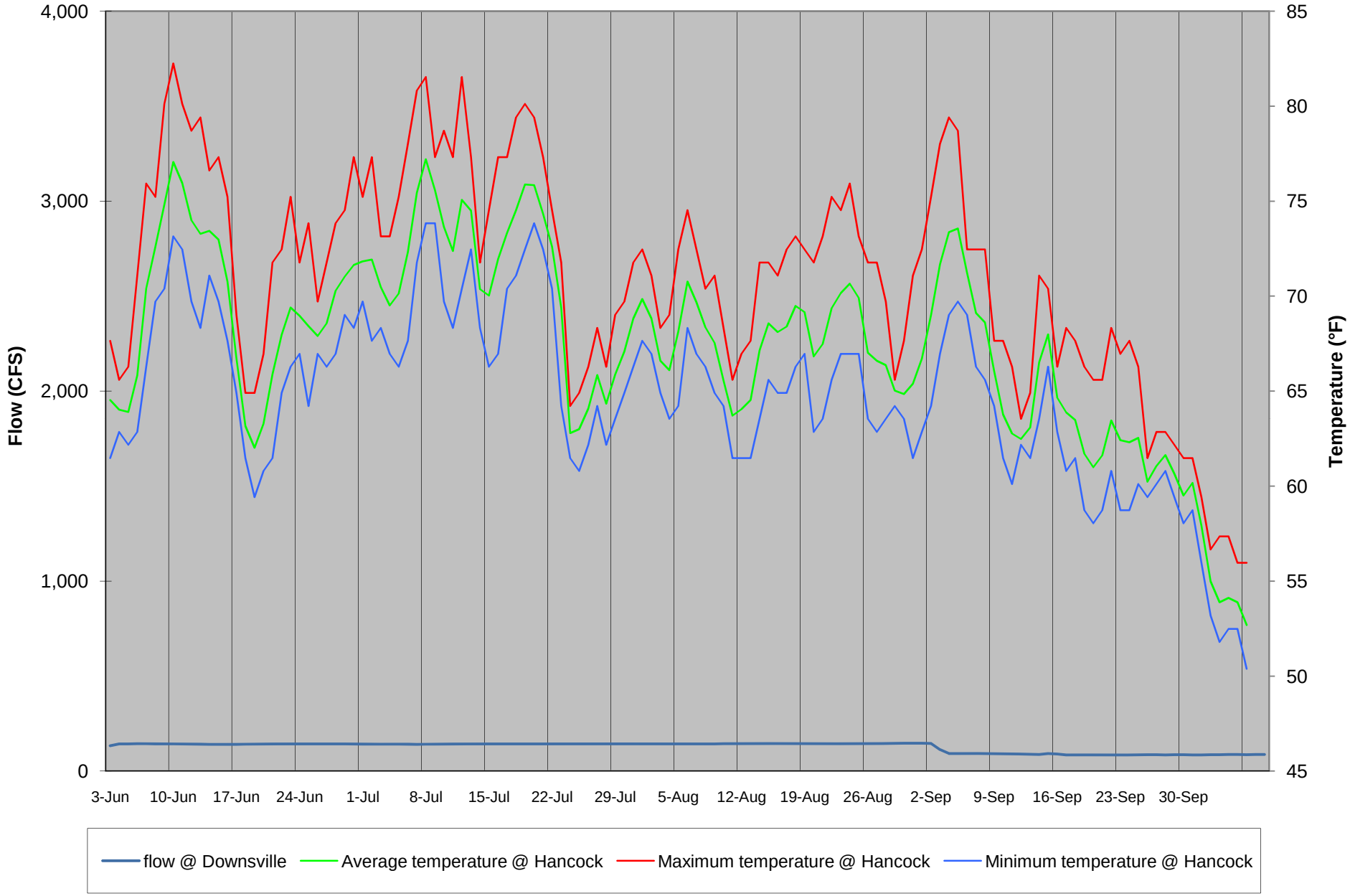
Appendix 1Q. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at East Branch, along with daily average flows at Downsville, 2008.



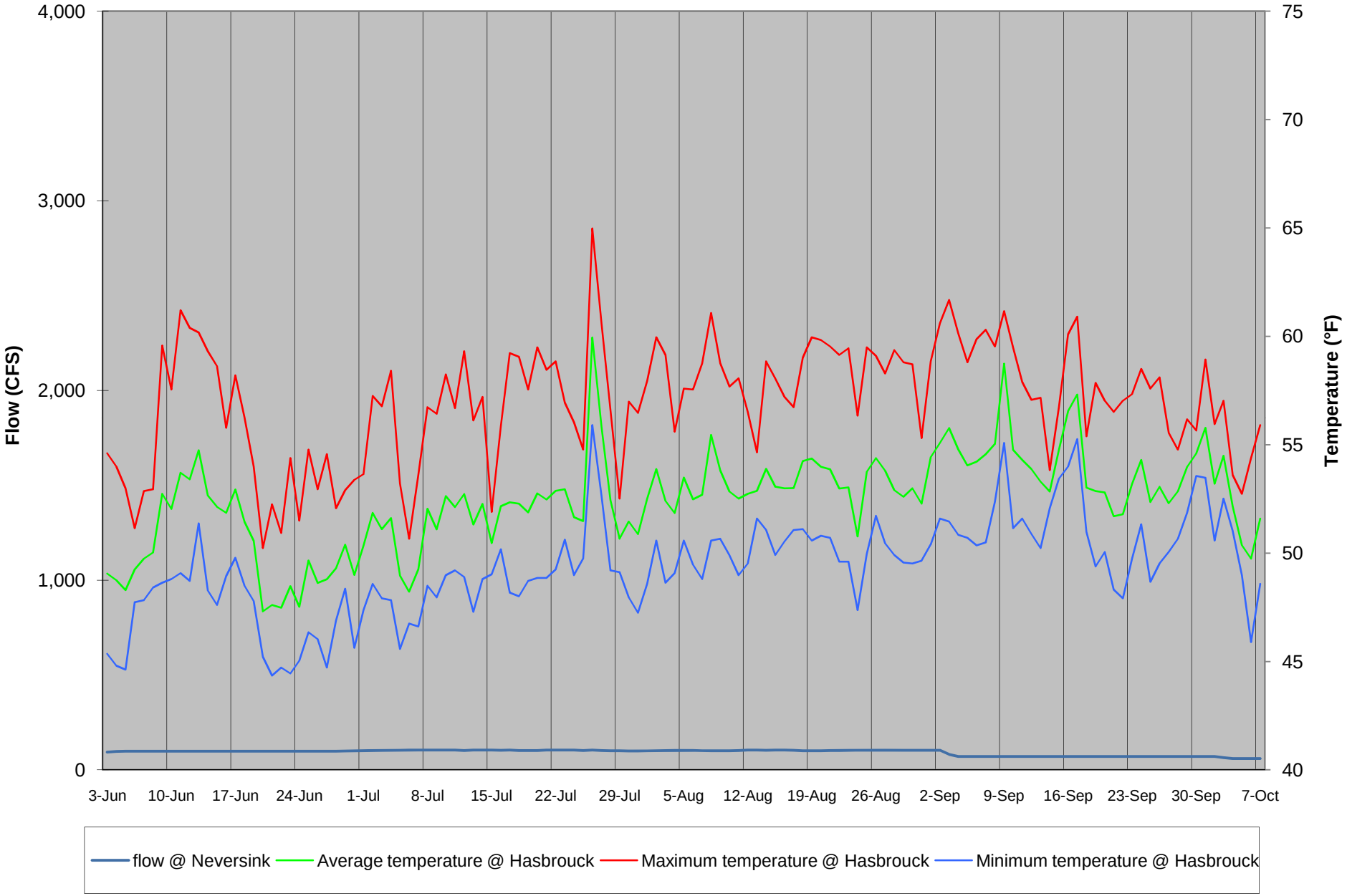
Appendix 1R. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the East Branch at Fishs Eddy, along with daily average flows at Downsville, 2008.



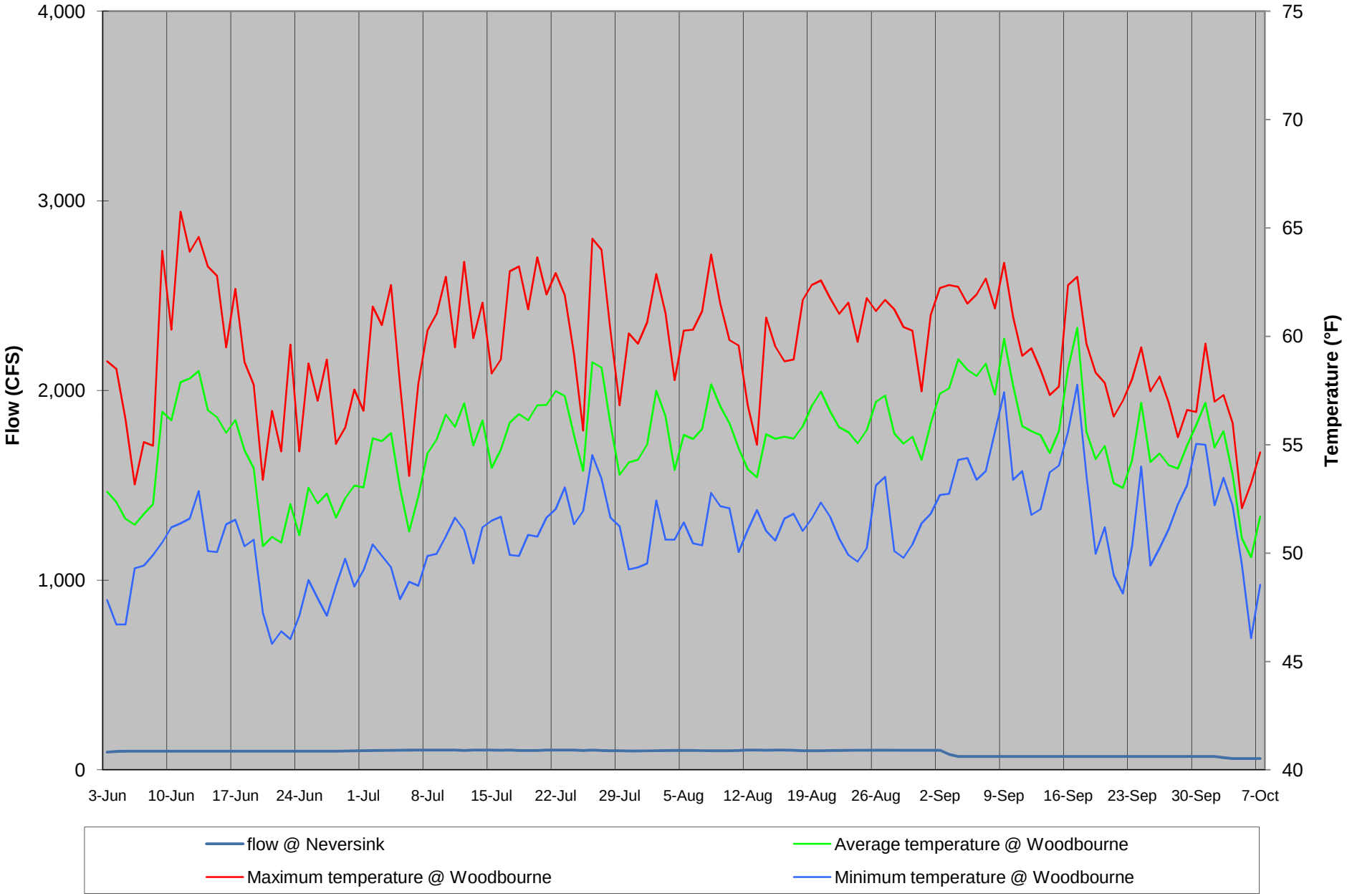
Appendix 1S. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Hancock, along with daily average flows at Downsville, 2008.



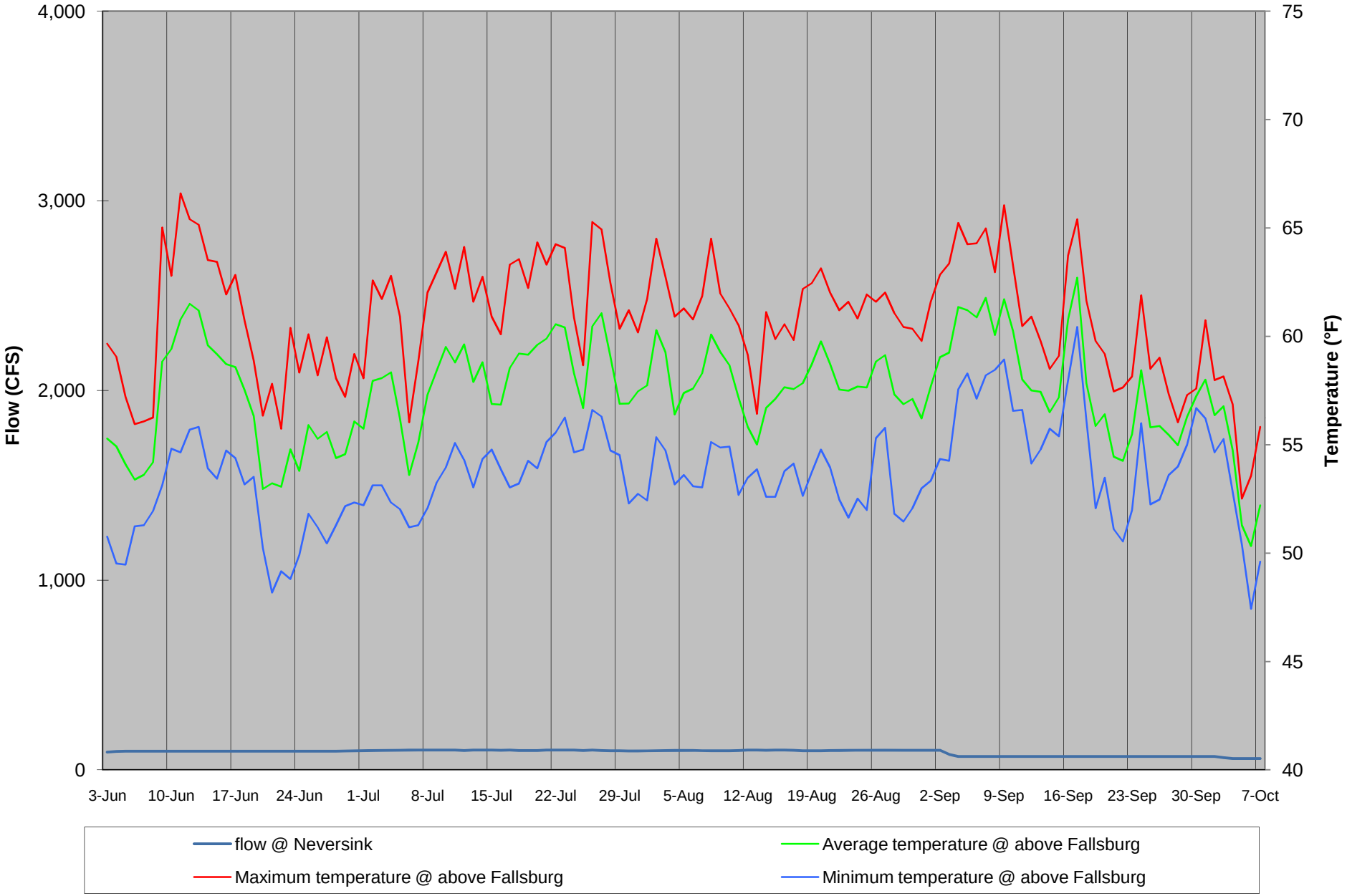
Appendix 1T. Summer daily average, maximum, and minimum water temperature profiles on the Neversink at Hasbrouck, along with daily average flows at Neversink, 2008.



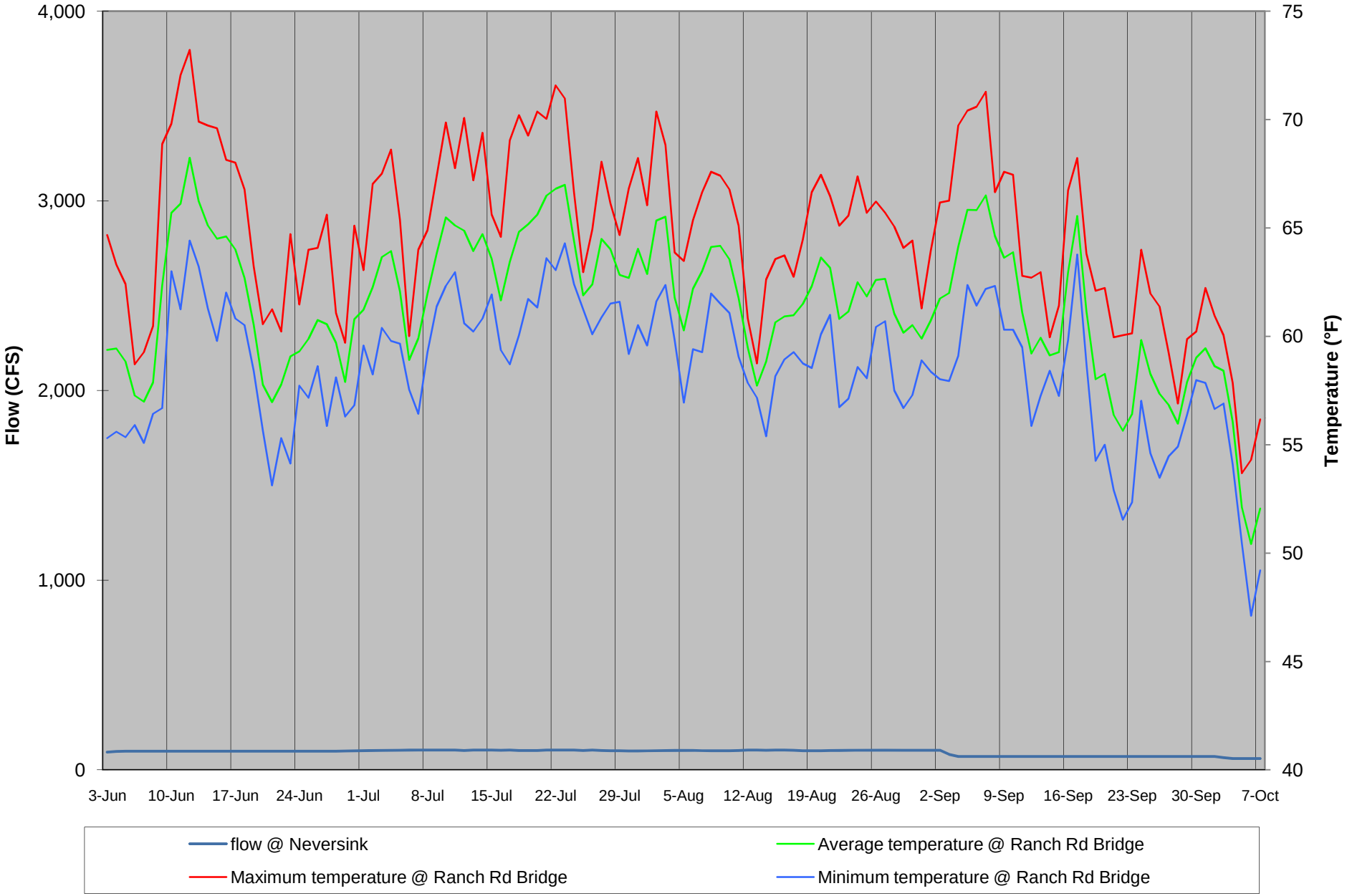
Appendix 1U. Summer daily average, maximum, and minimum water temperature profiles on the Neversink at Woodbourne, along with daily average flows at Neversink, 2008.



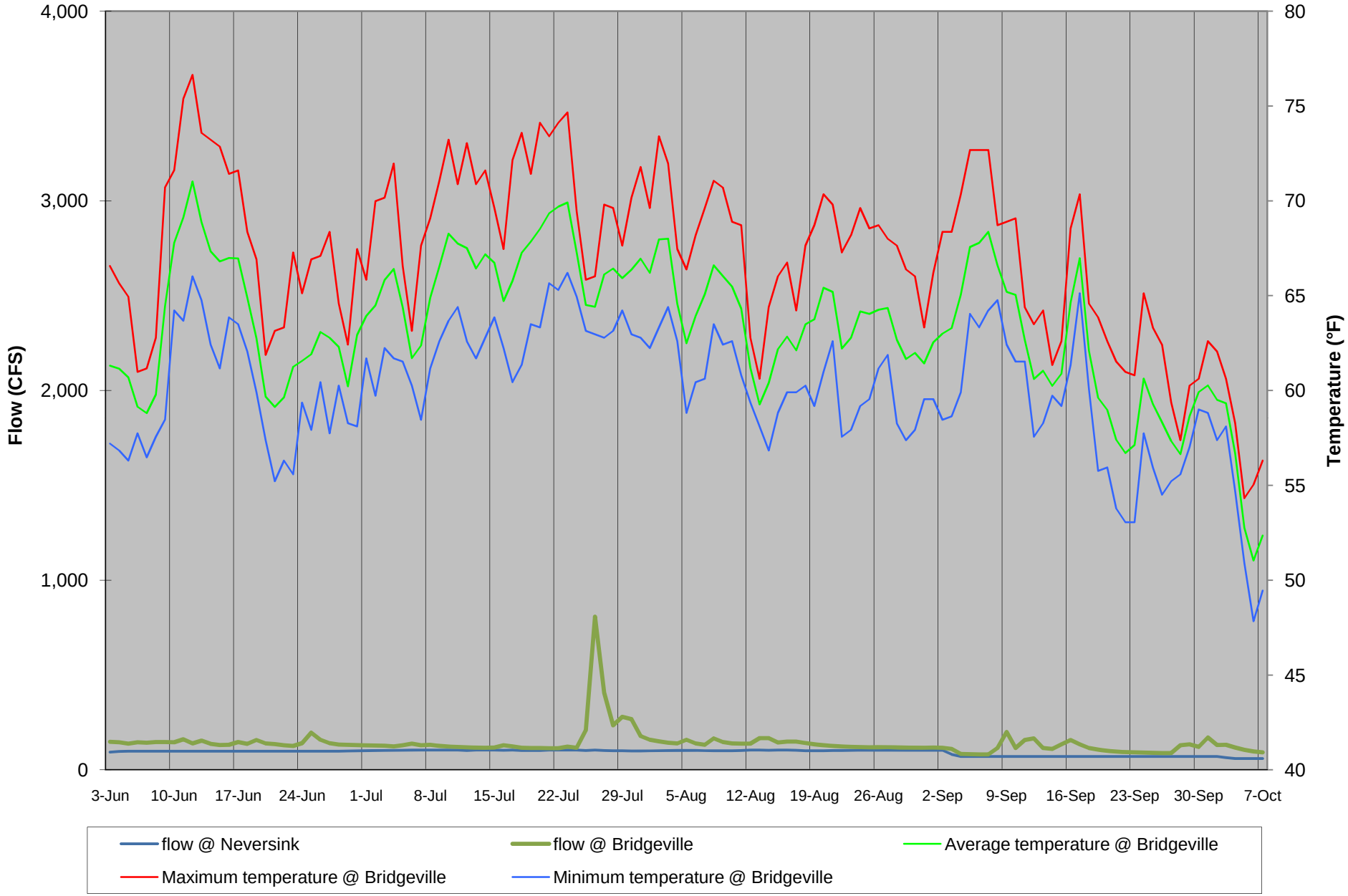
Appendix 1V. Summer daily average, maximum, and minimum water temperature profiles on the Neversink just above Fallsburg, along with daily average flows at Neversink, 2008.



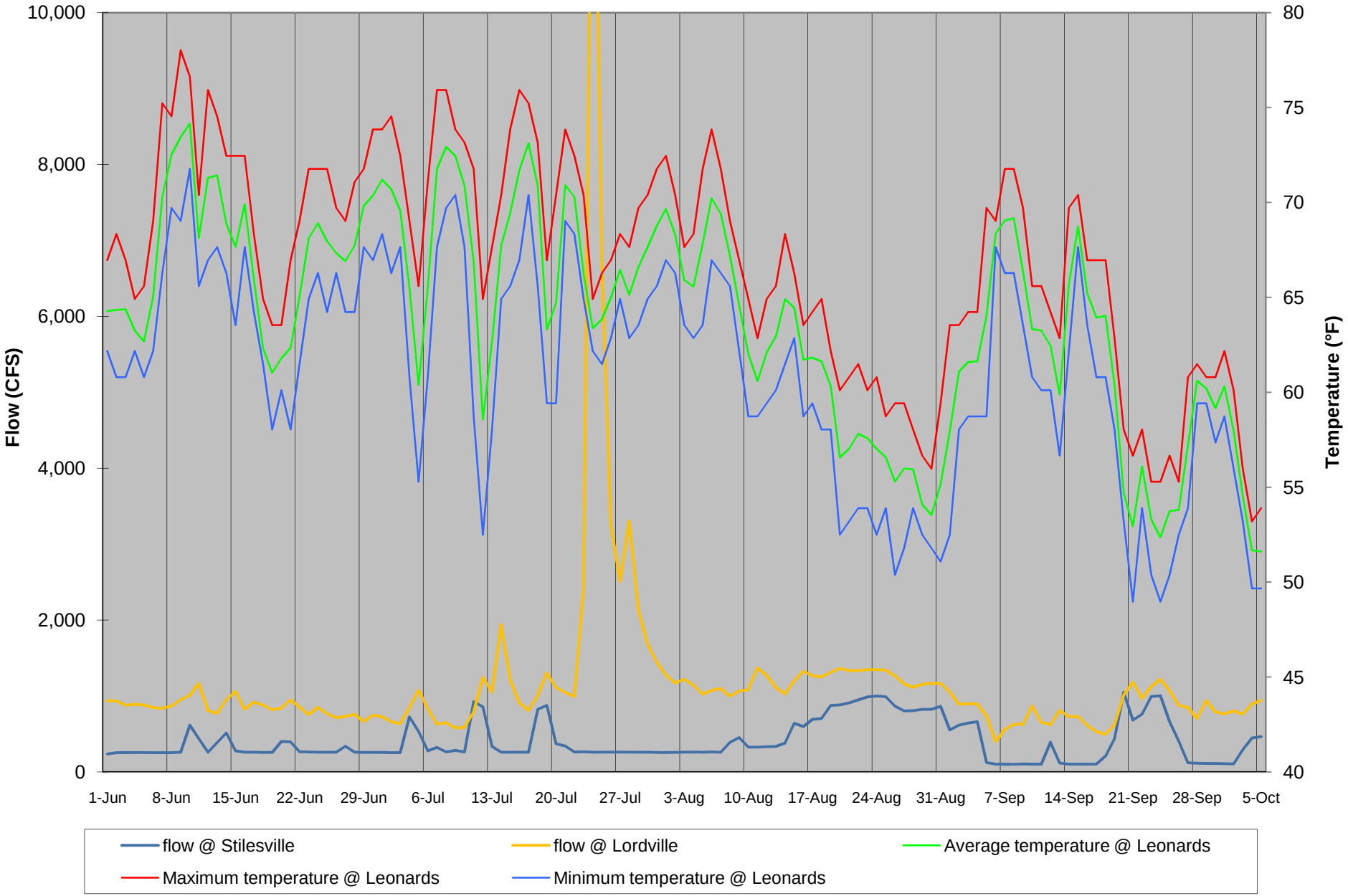
Appendix 1W. Summer daily average, maximum, and minimum water temperature profiles on the Neversink at Ranch Rd bridge, along with daily average flows at Neversink, 2008.



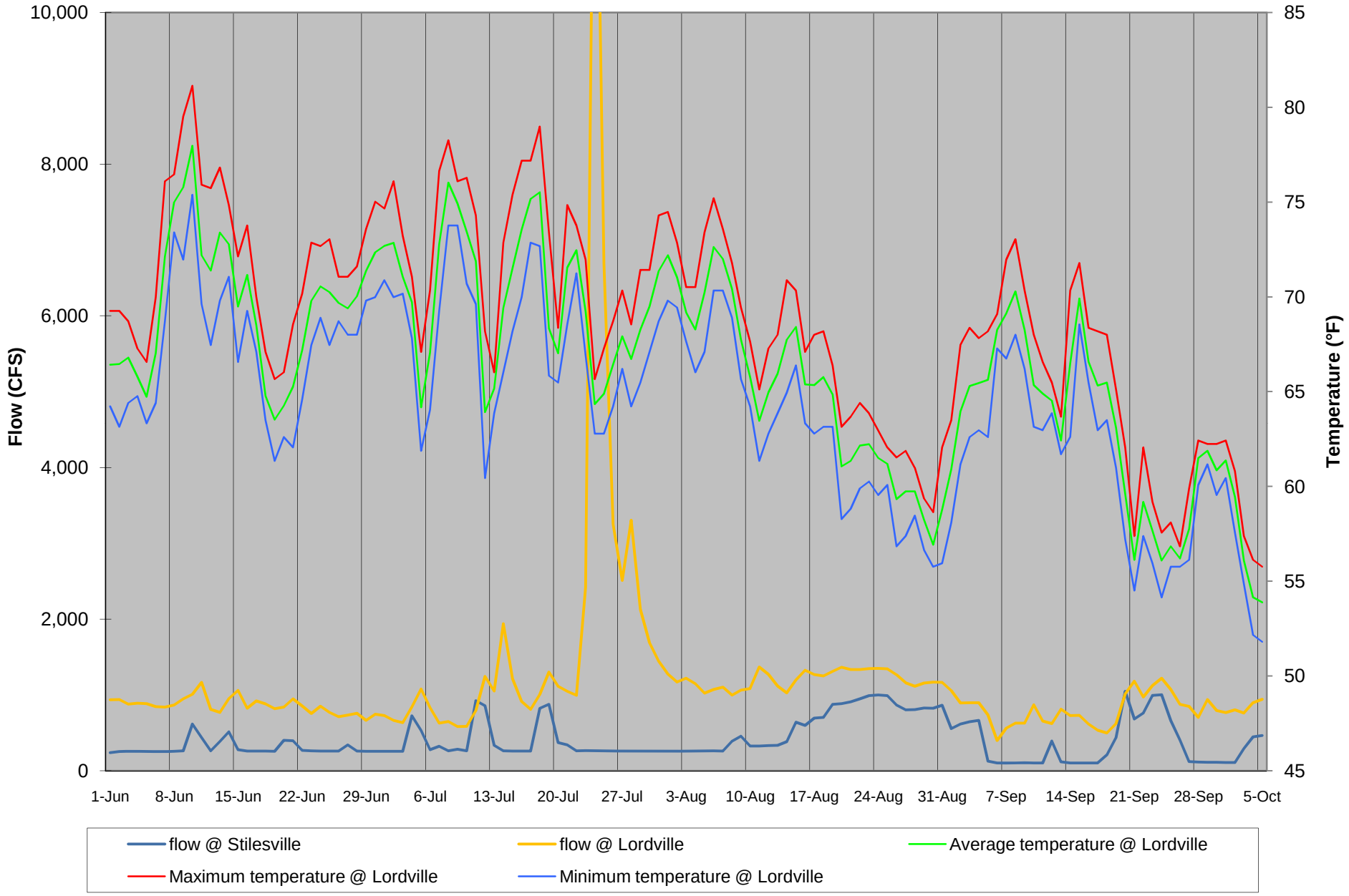
Appendix 1X. Summer daily average, maximum, and minimum water temperature profiles on the Neversink at Bridgeville, along with daily average flows at Bridgeville & Neversink, 2008.



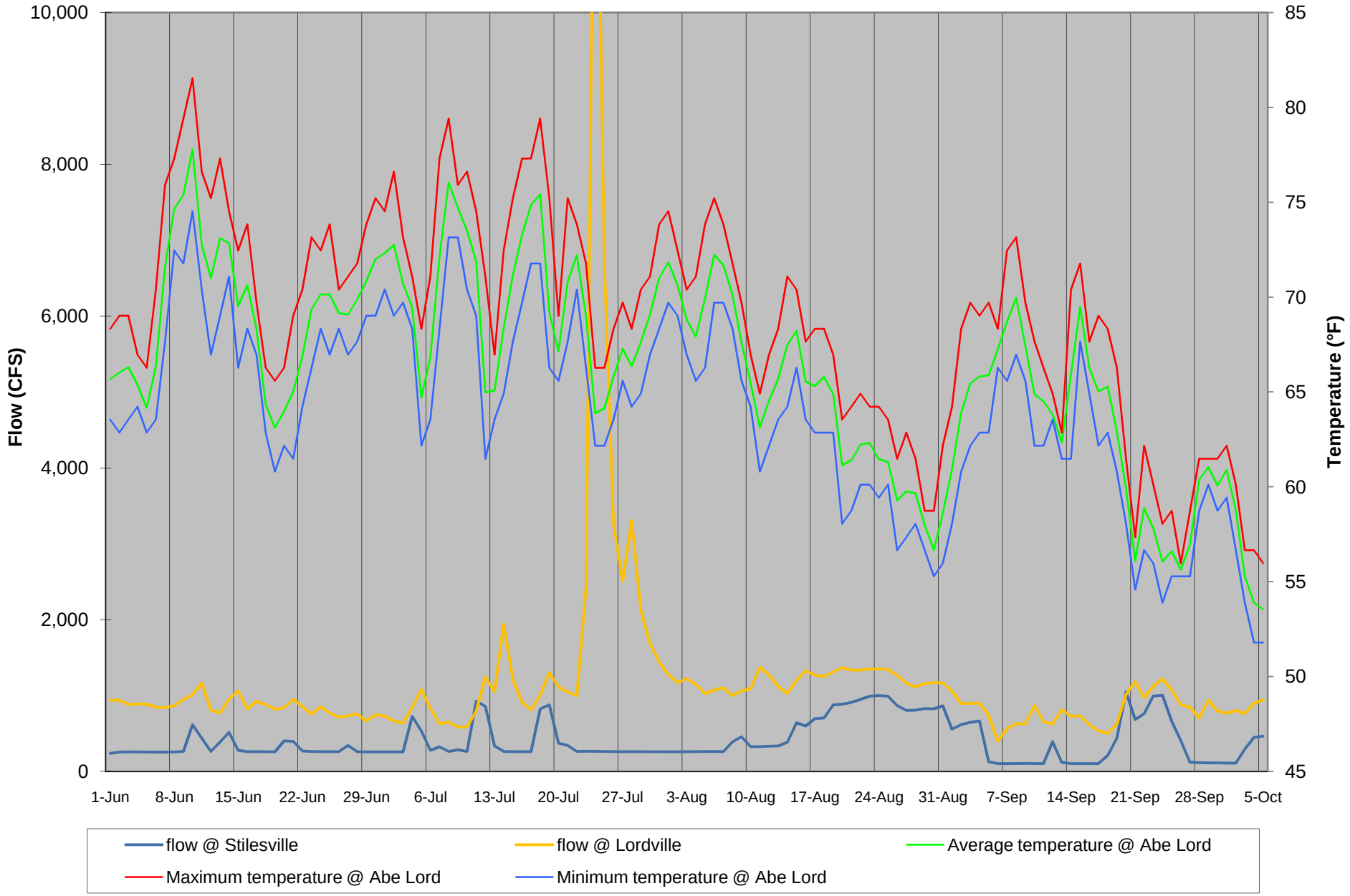
Appendix 1Y. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Leonards, along with daily average flows at Stilesville on the West Branch and Lordville, 2008.



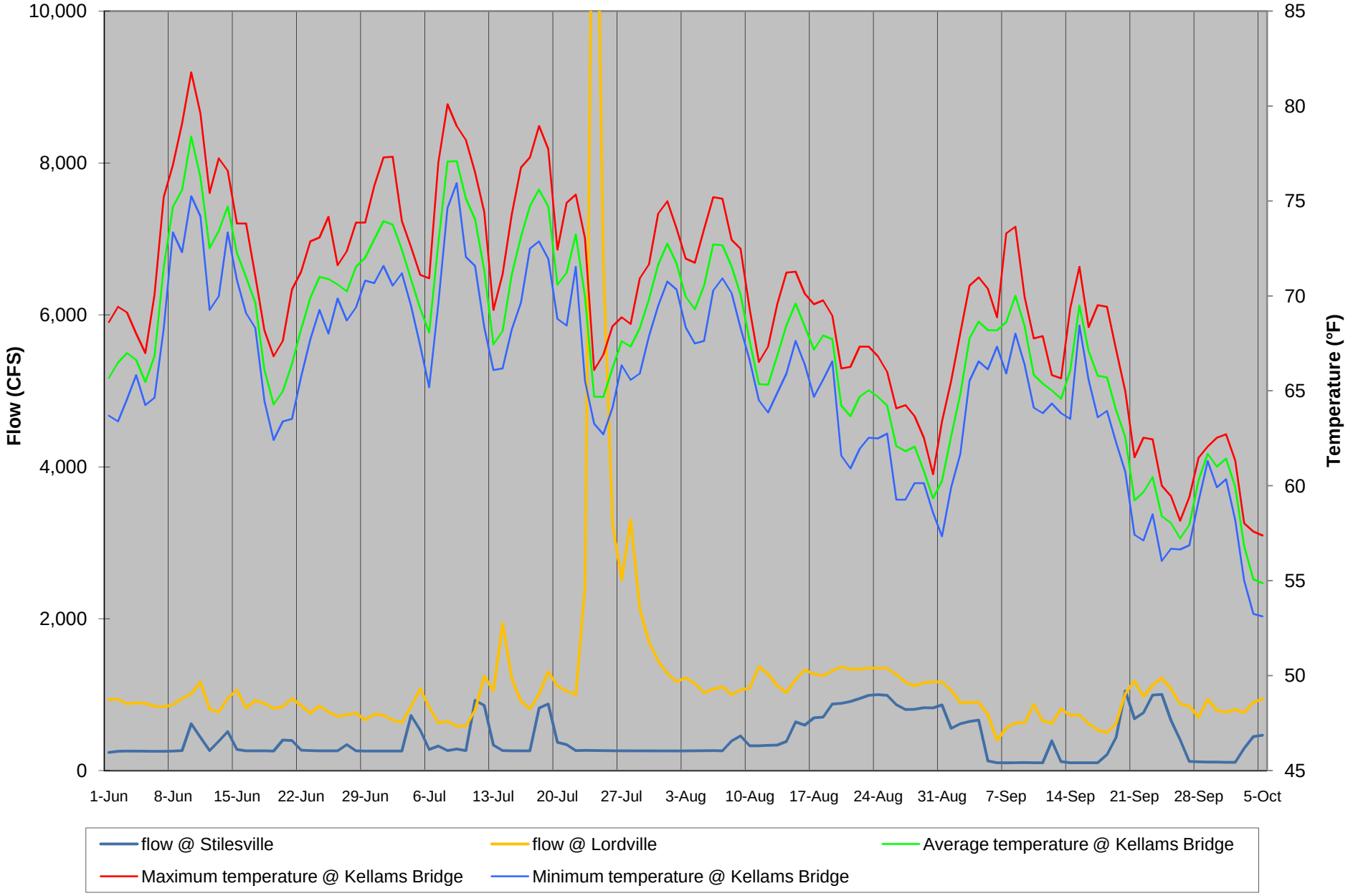
Appendix 1Z. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Lordville, along with daily average flows at Stilesville on the West Branch and Lordville, 2008.



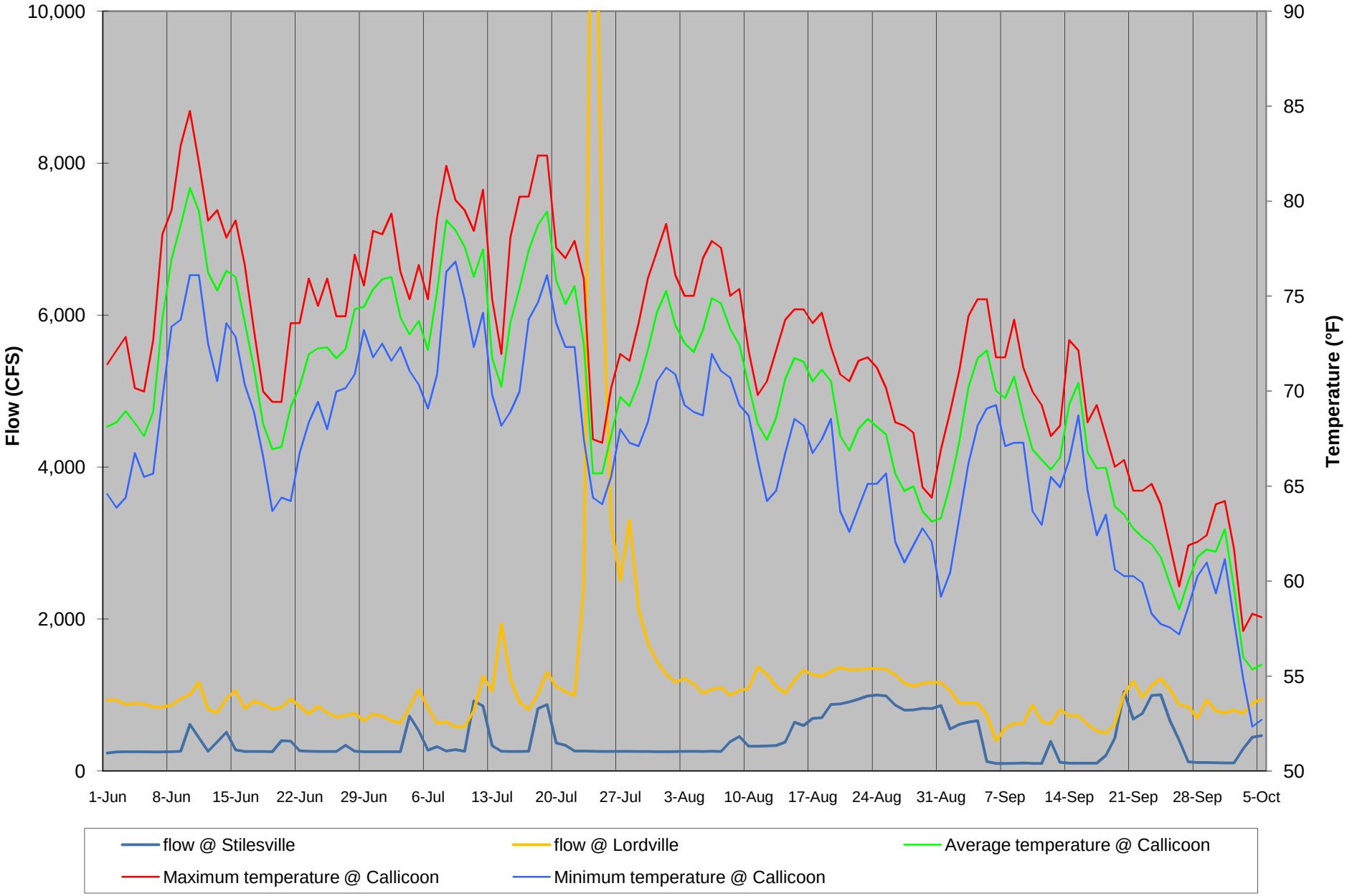
Appendix 1AA. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Abe Lord, along with daily average flows at Stilesville on the West Branch and Lordville, 2008.



Appendix 1BB. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Kellams Bridge, along with daily average flows at Stilesville on the West Branch and Lordville, 2008.



Appendix 1CC. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Callicoon, along with daily average flows at Stilesville on the West Branch and Lordville, 2008.



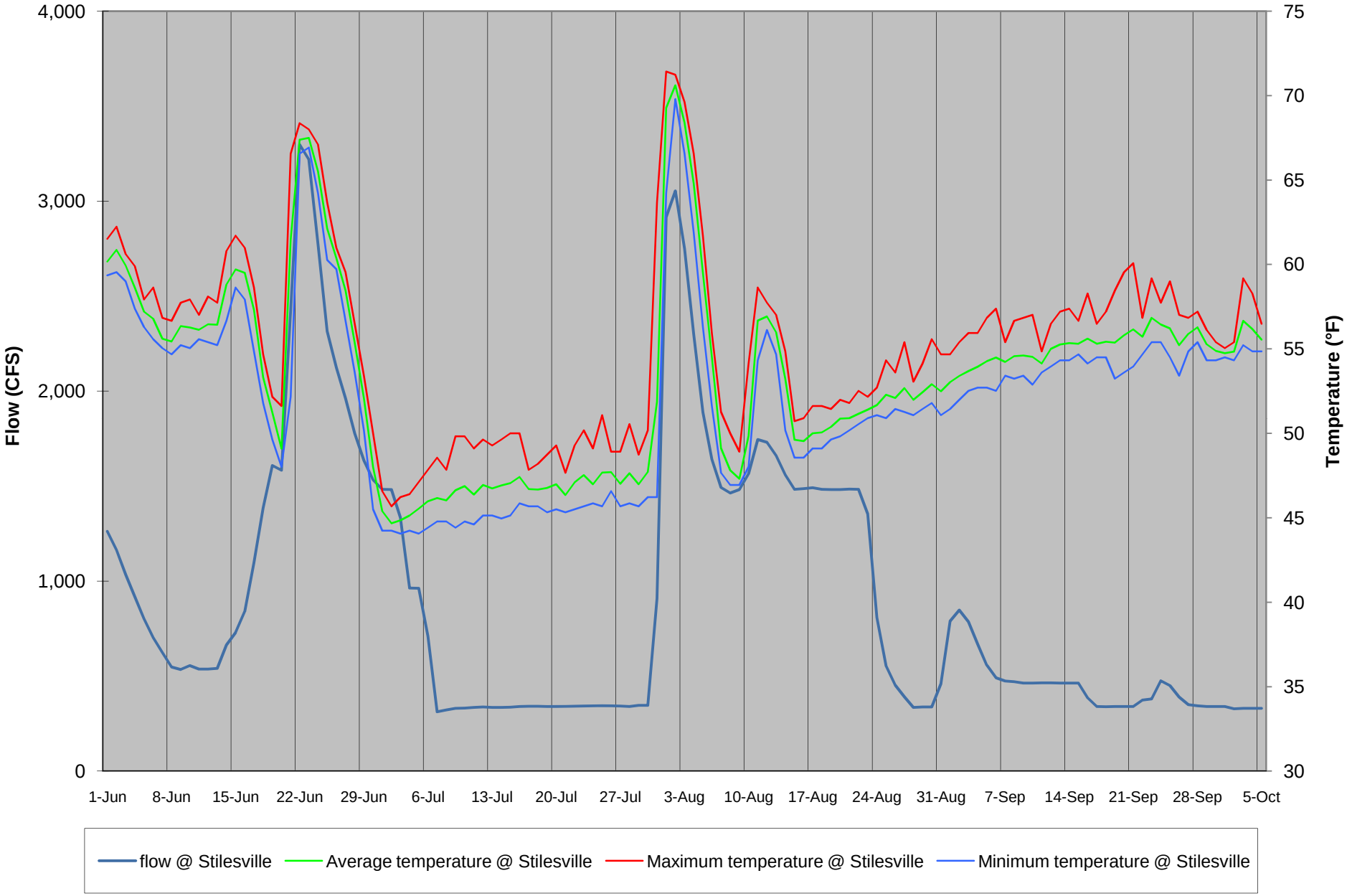
Appendix 2:

UPPER DELAWARE TAILWATERS

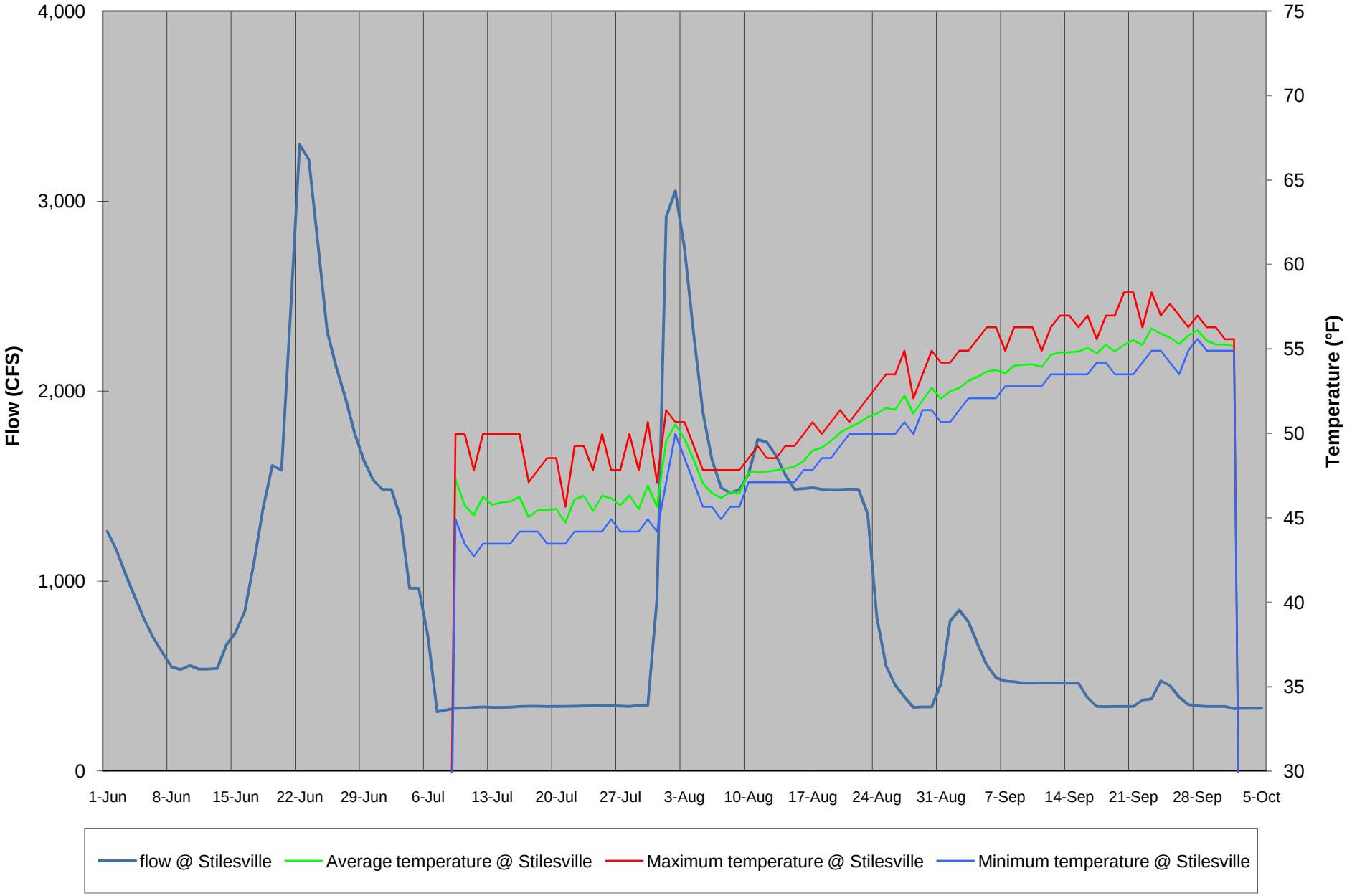
Maxima, minima, and average summer water temperature profile for each temperature monitoring site, 2009

West Branch: Appendices 2A to 2J
East Branch: Appendices 2K to 2S
Neversink River: Appendices 2T to 2X
Delaware River: Appendices 2Y to 2CC

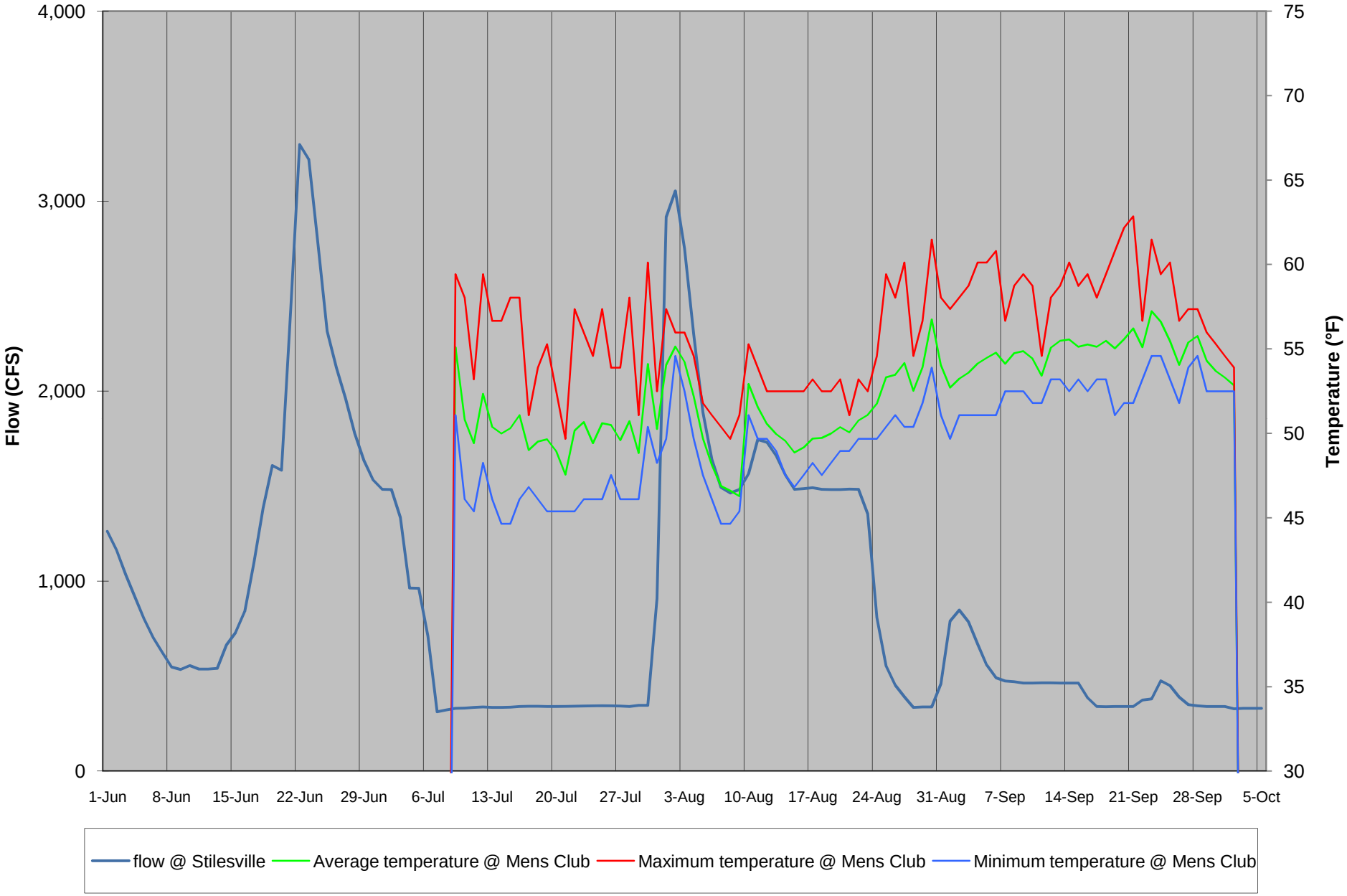
Appendix 2A. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the West Branch at Stilesville, along with daily average flows at Stilesville, 2009.



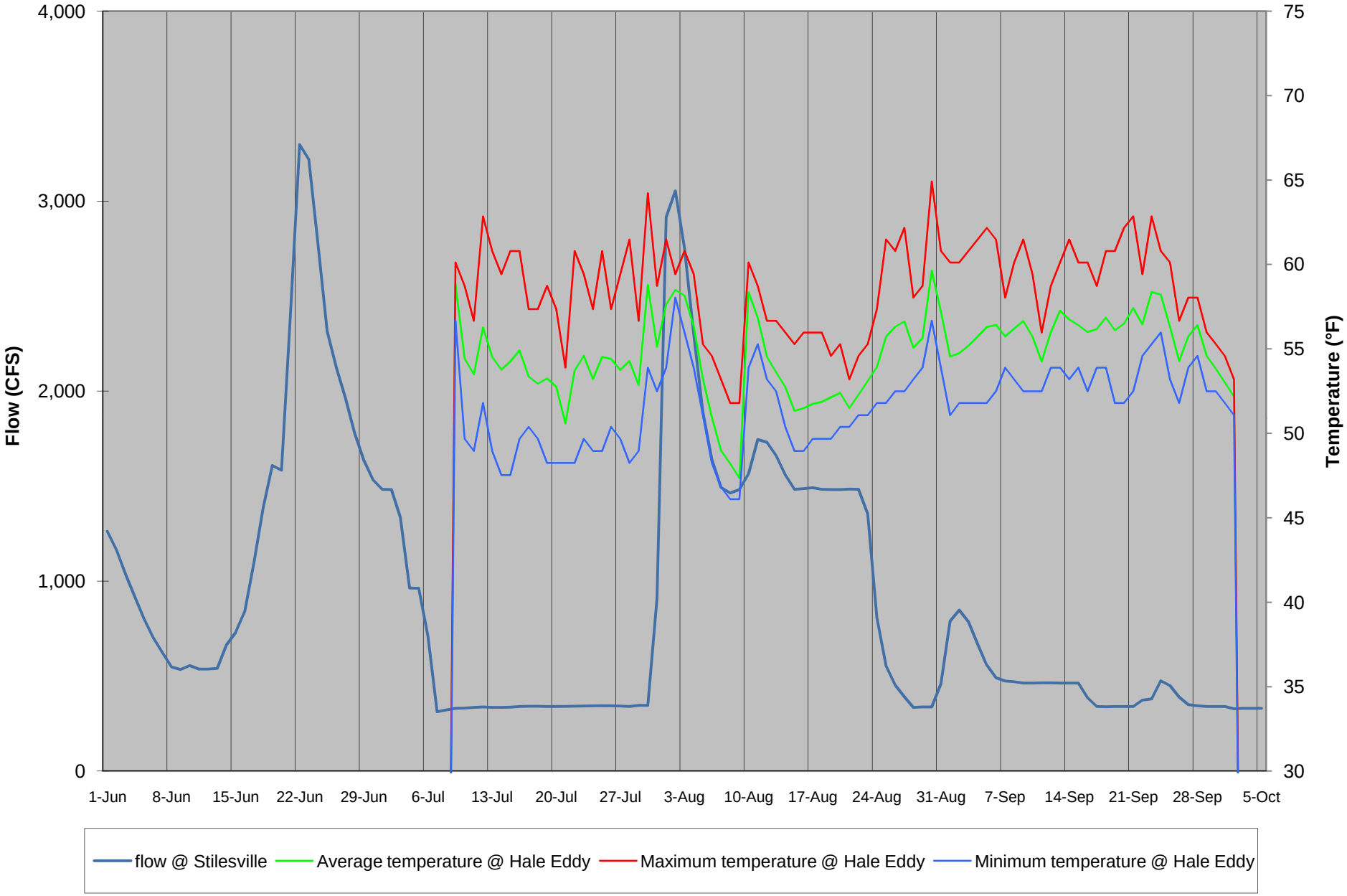
Appendix 2B. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Stilesville, along with daily average flows at Stilesville, 2009.



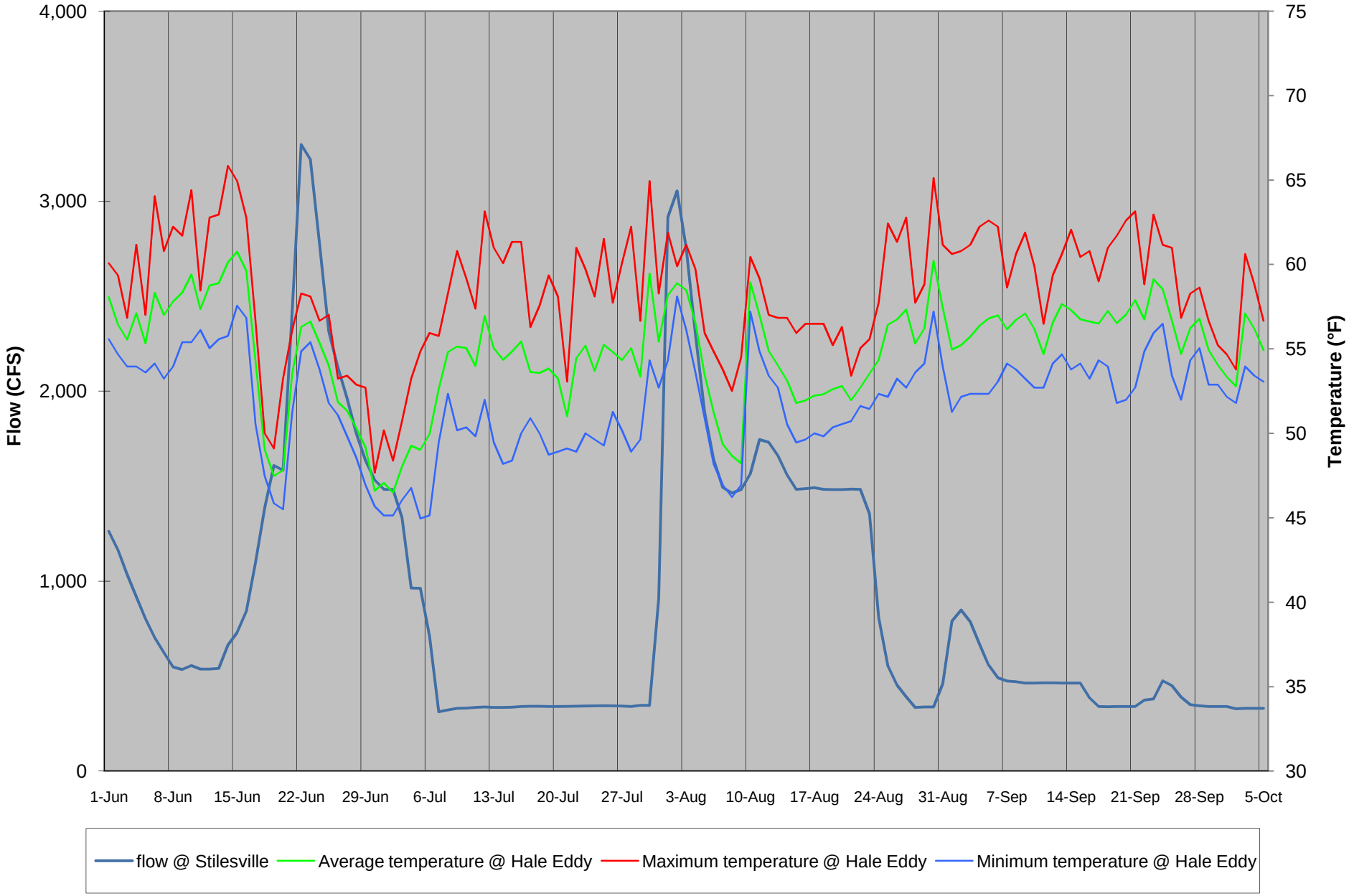
Appendix 2C. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Mens Club, along with daily average flows at Stilesville, 2009.



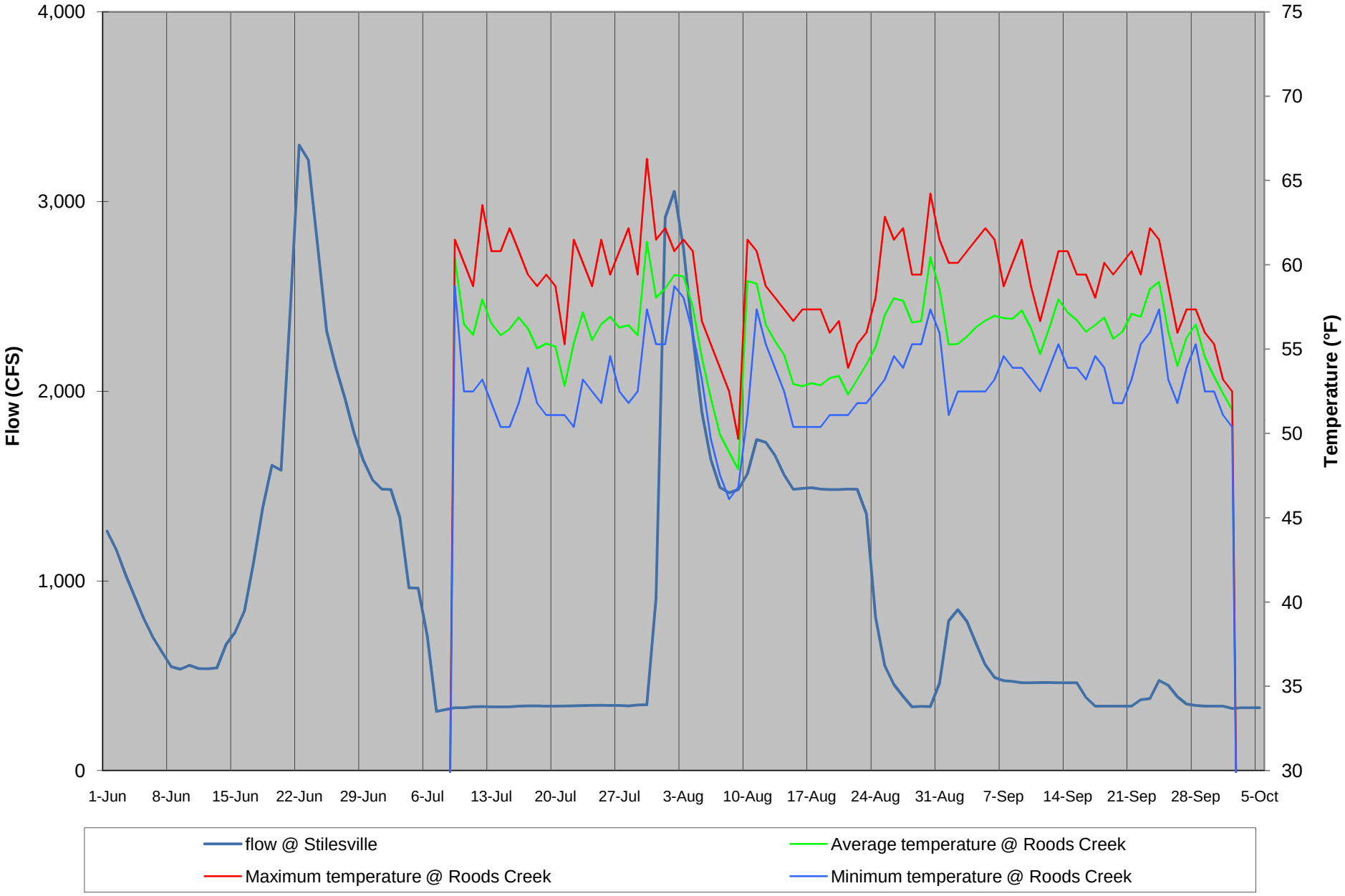
Appendix 2D. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Hale Eddy, along with daily average flows at Stilesville, 2009.



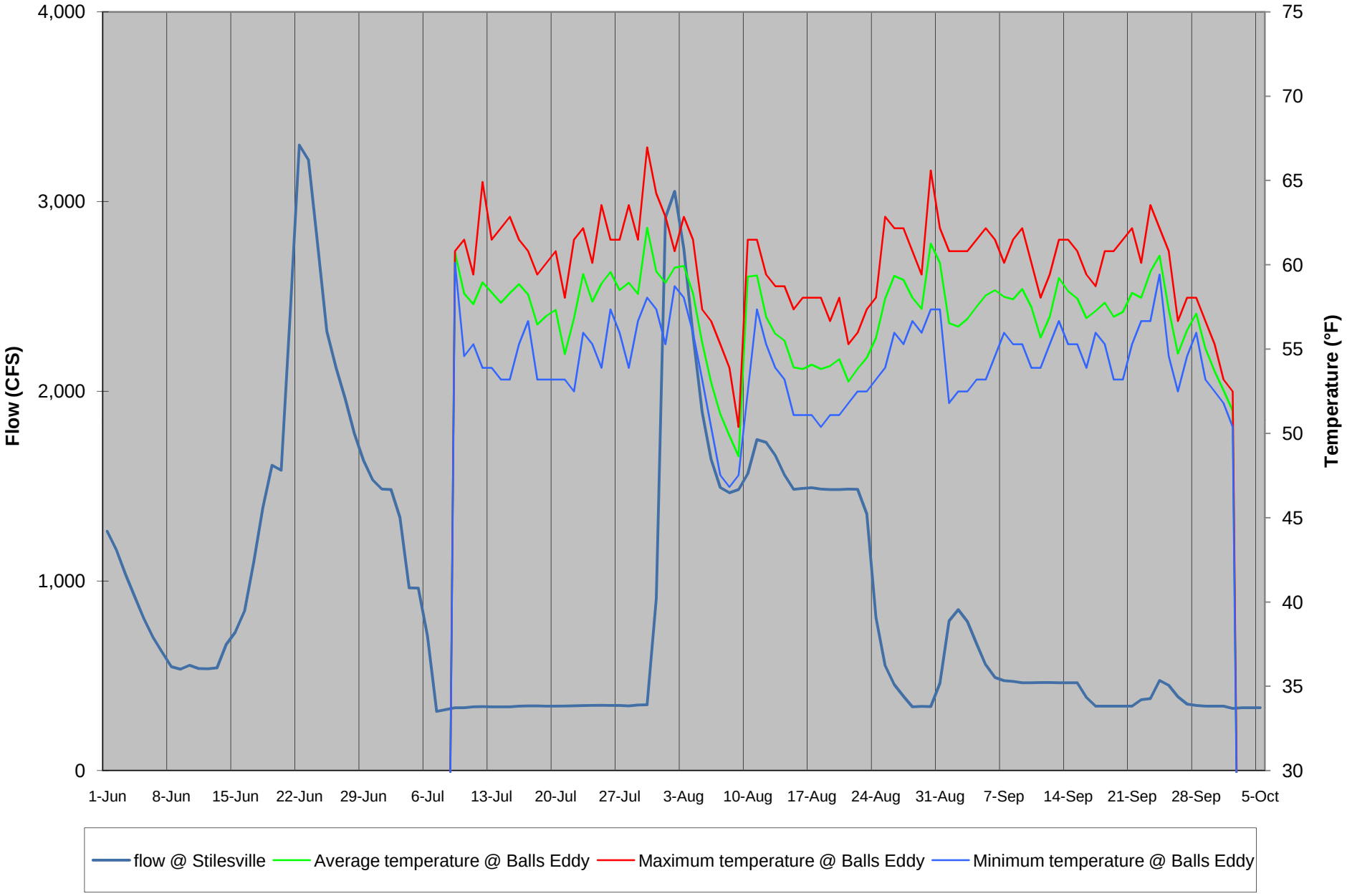
Appendix 2E. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the West Branch at Hale Eddy, along with daily average flows at Stilesville, 2009.



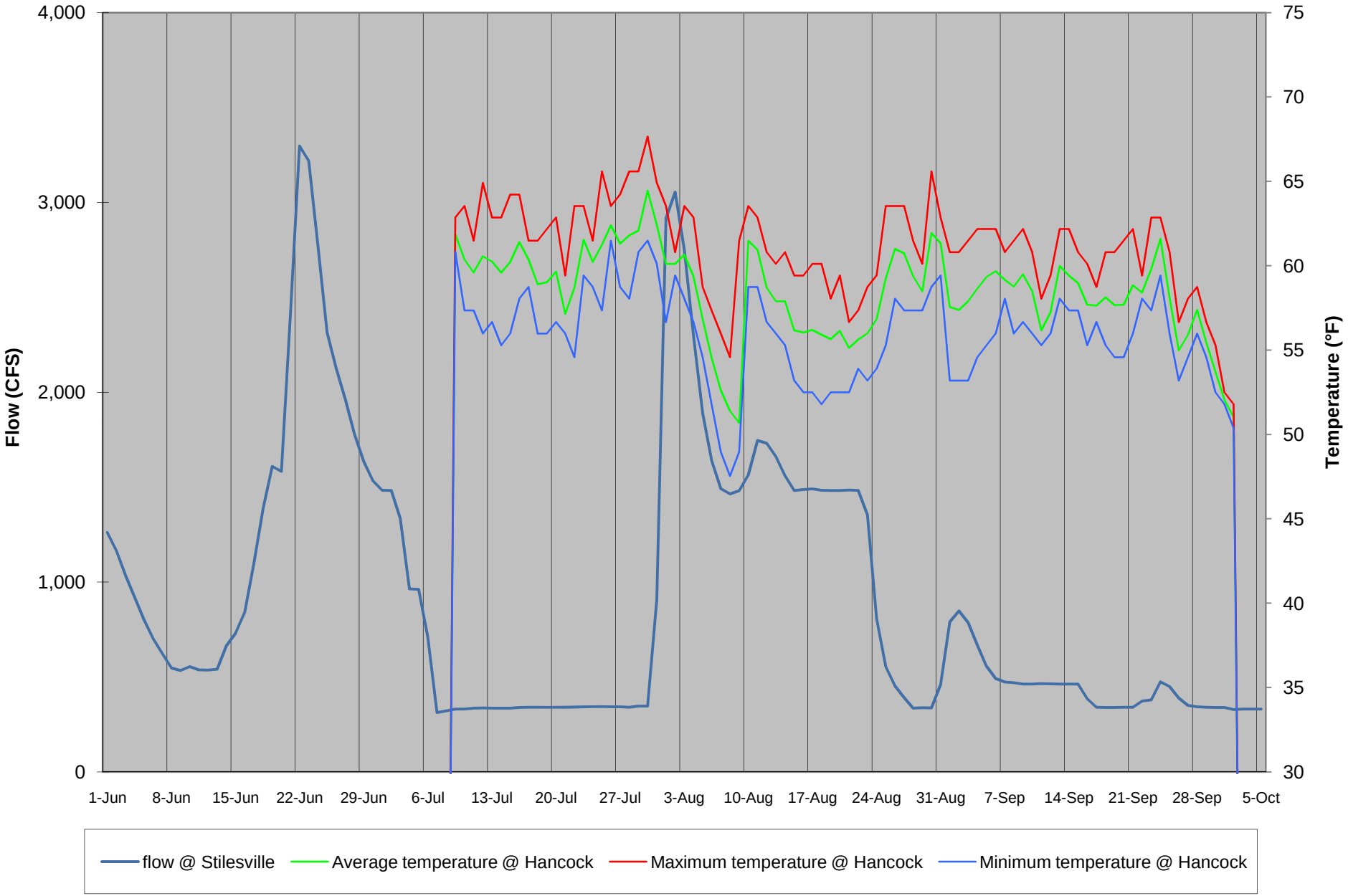
Appendix 2F. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Roods Creek, along with daily average flows at Stilesville, 2009.



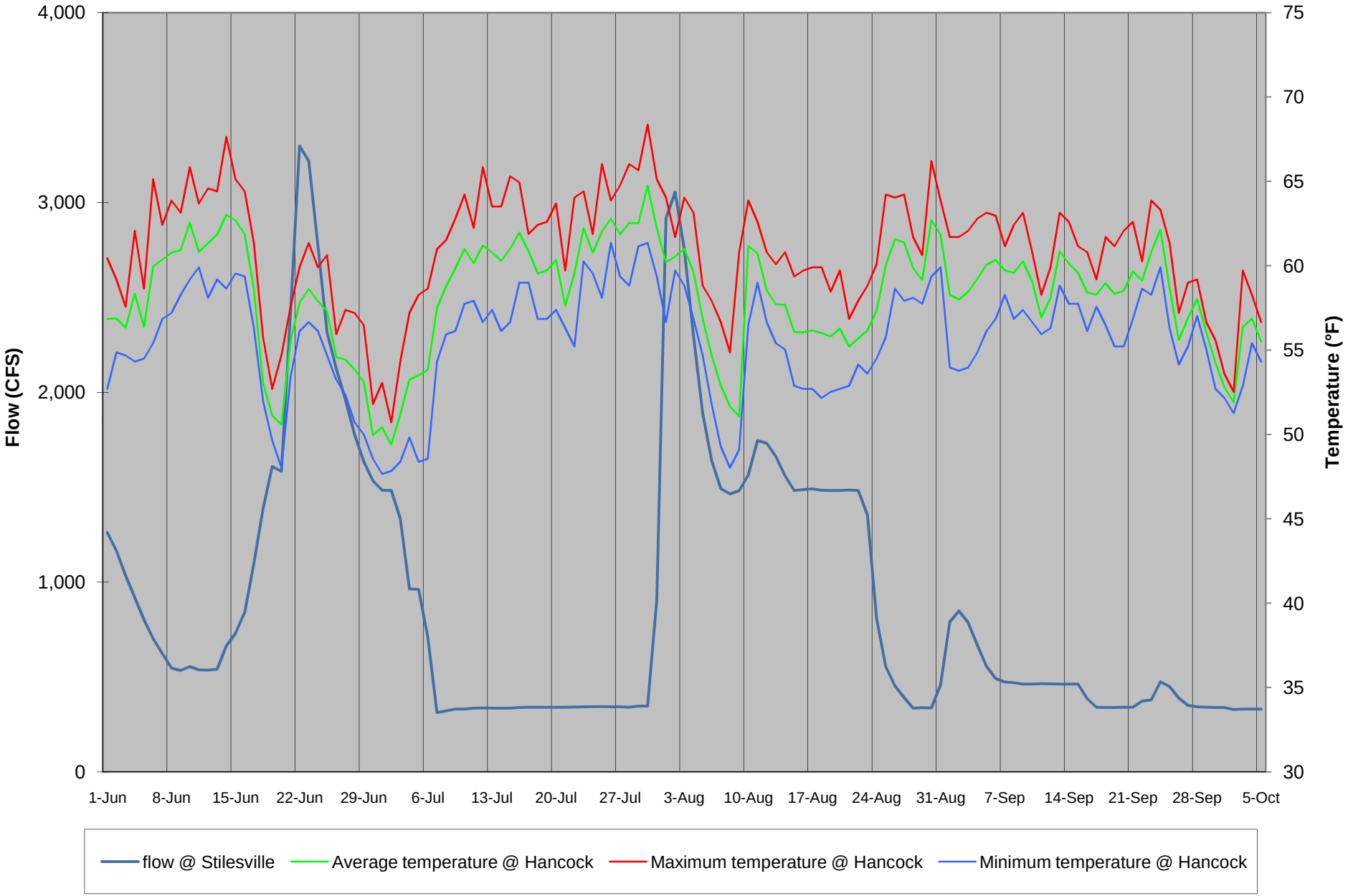
Appendix 2G. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Balls Eddy, along with daily average flows at Stilesville, 2009.



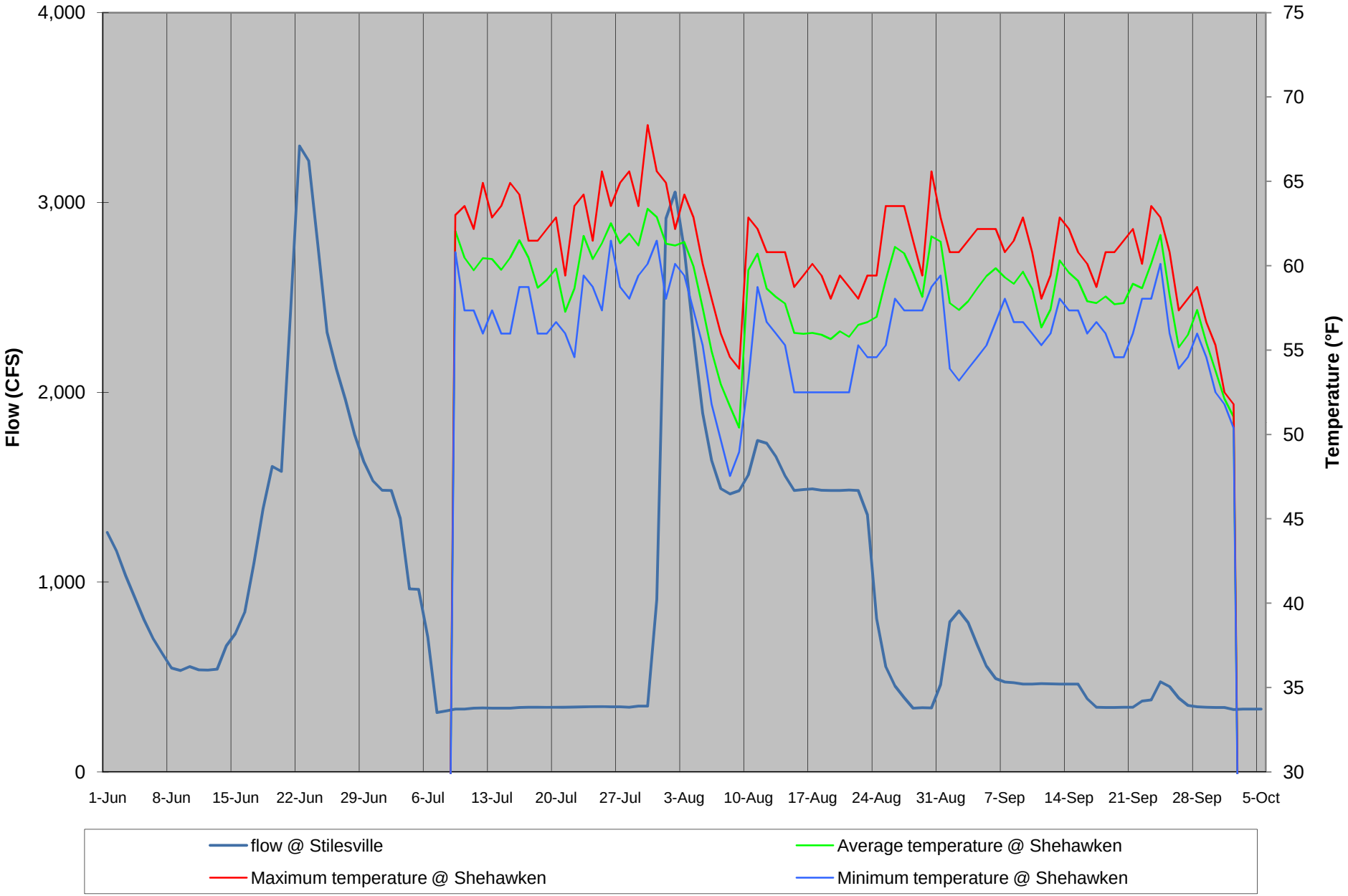
Appendix 2H. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Hancock, along with daily average flows at Stilesville, 2009.



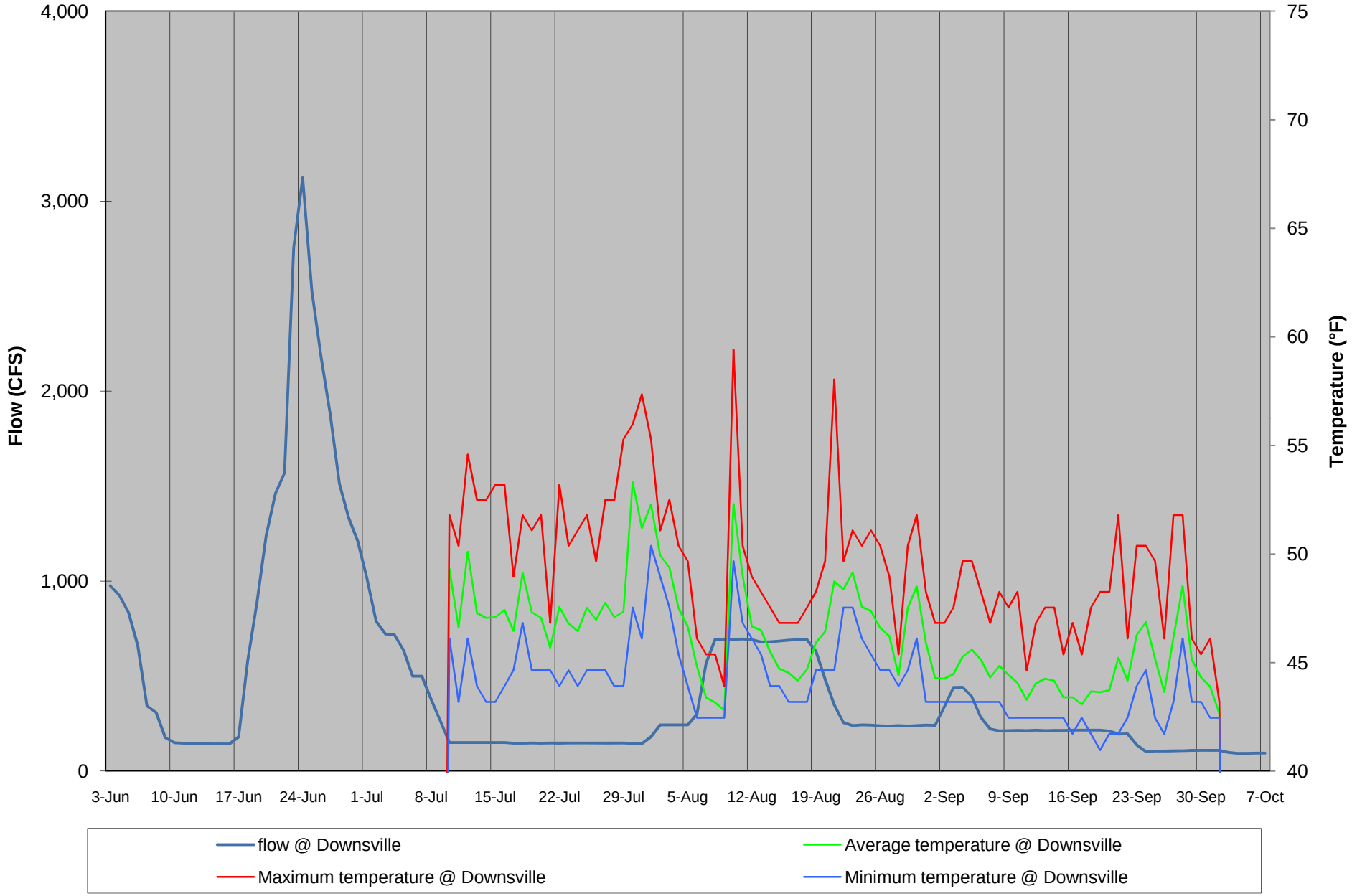
Appendix 2I. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the West Branch at Hancock, along with daily average flows at Stilesville, 2009.



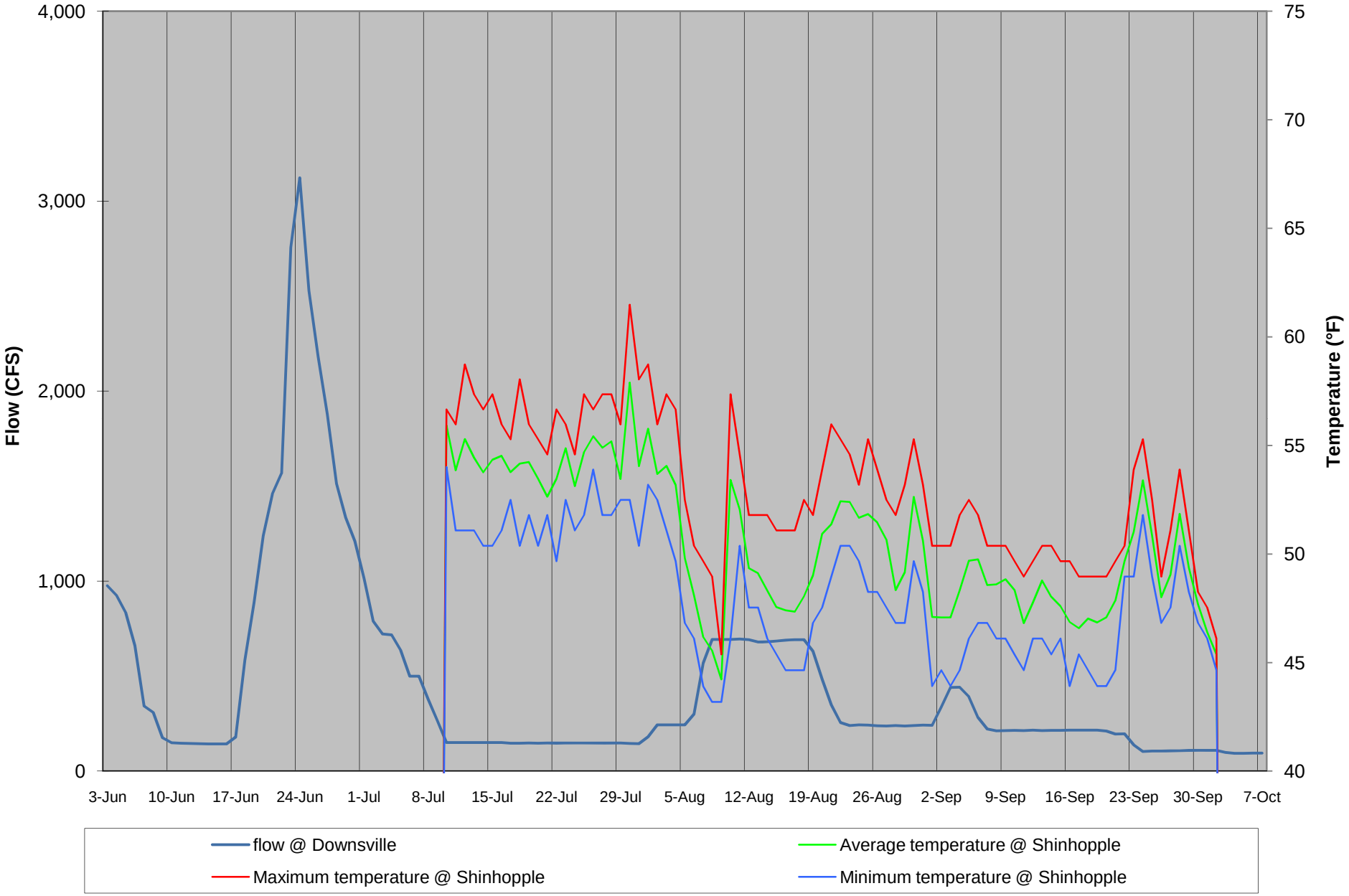
Appendix 2J. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Shehawken, along with daily average flows at Stilesville, 2009.



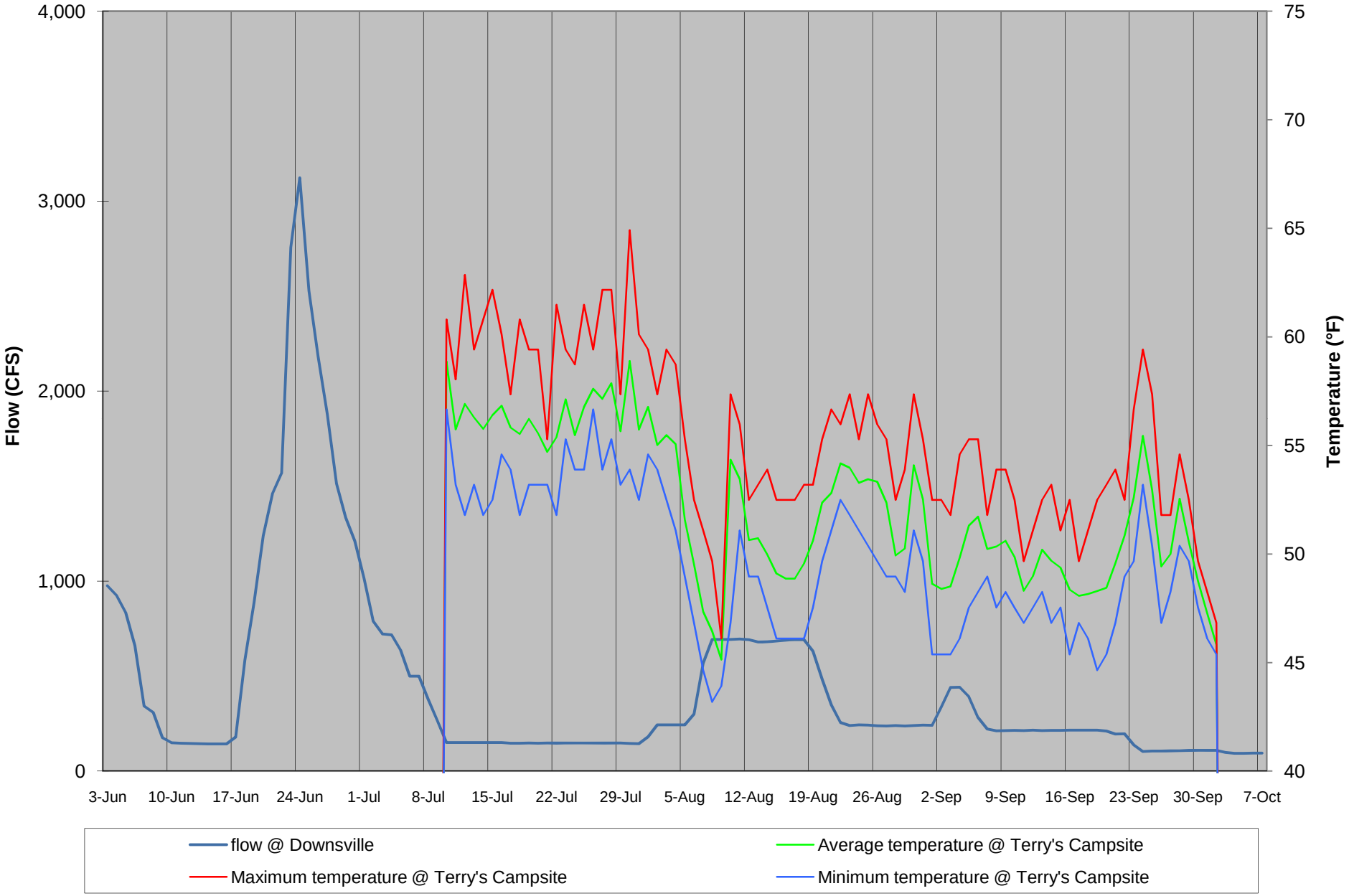
Appendix 2K. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Downsville, along with daily average flows at Downsville, 2009.



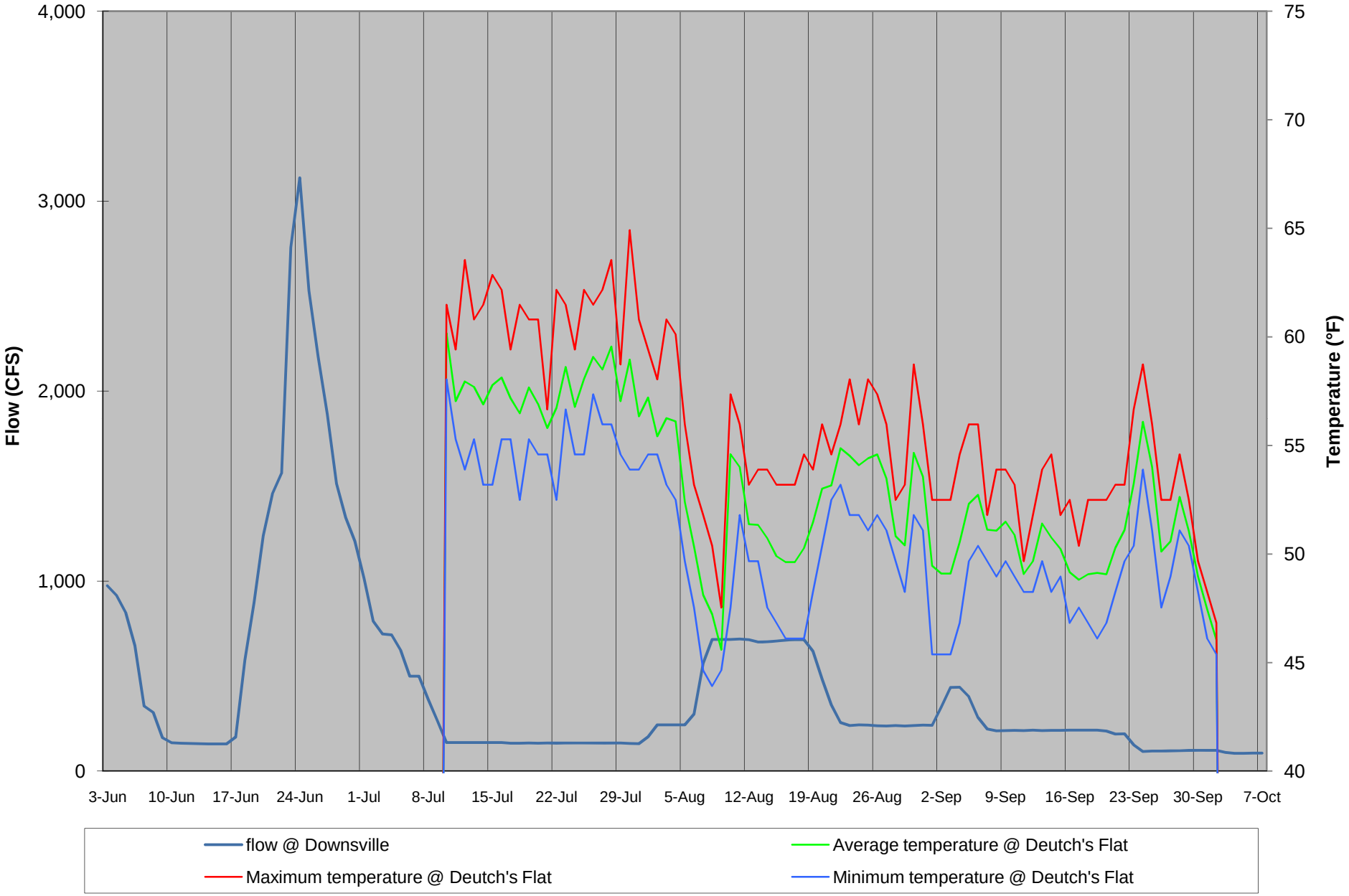
Appendix 2L. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Shinhopple, along with daily average flows at Downsville, 2009.



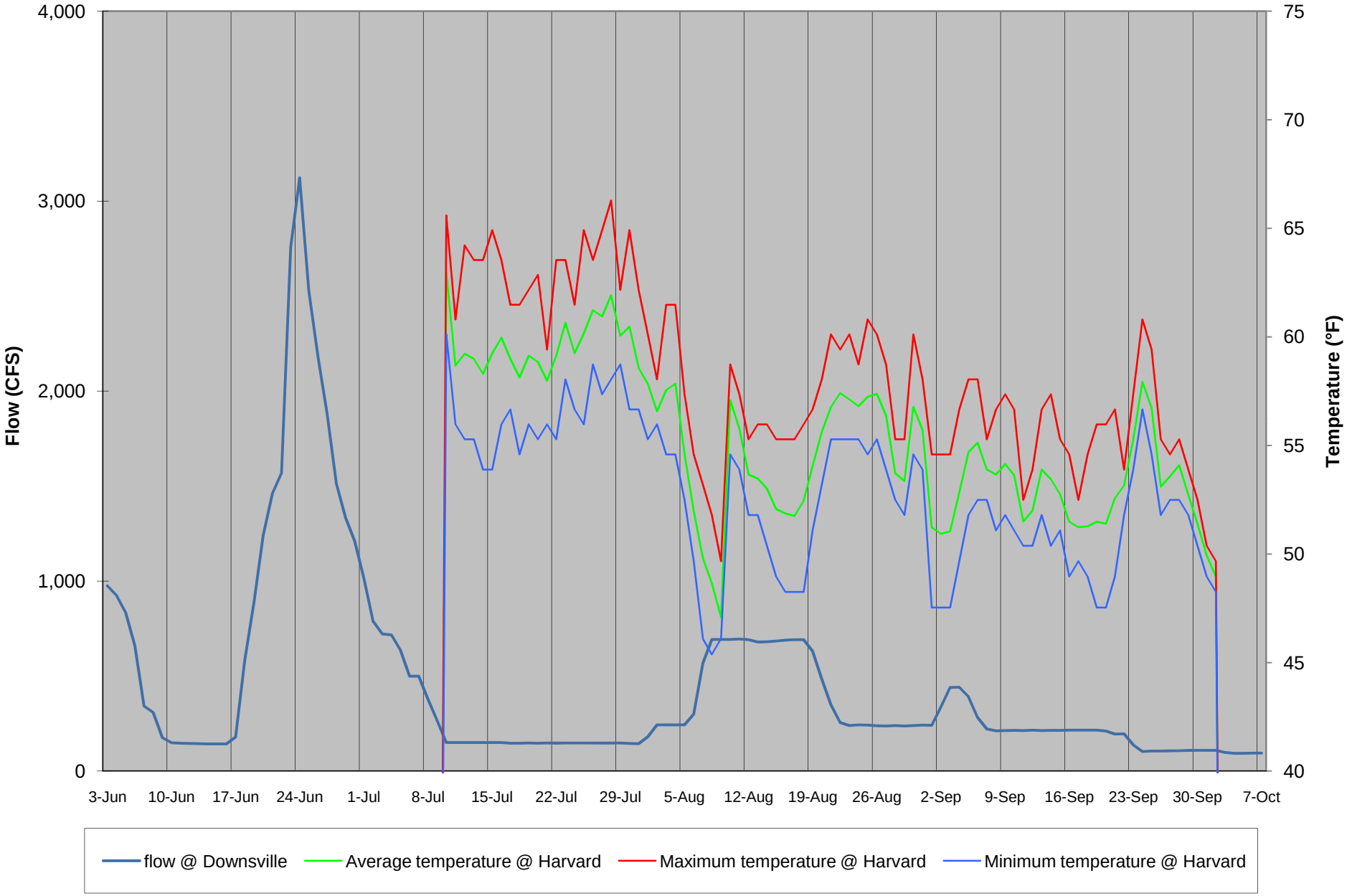
Appendix 2M. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Terry's Campsite, along with daily average flows at Downsville, 2009.



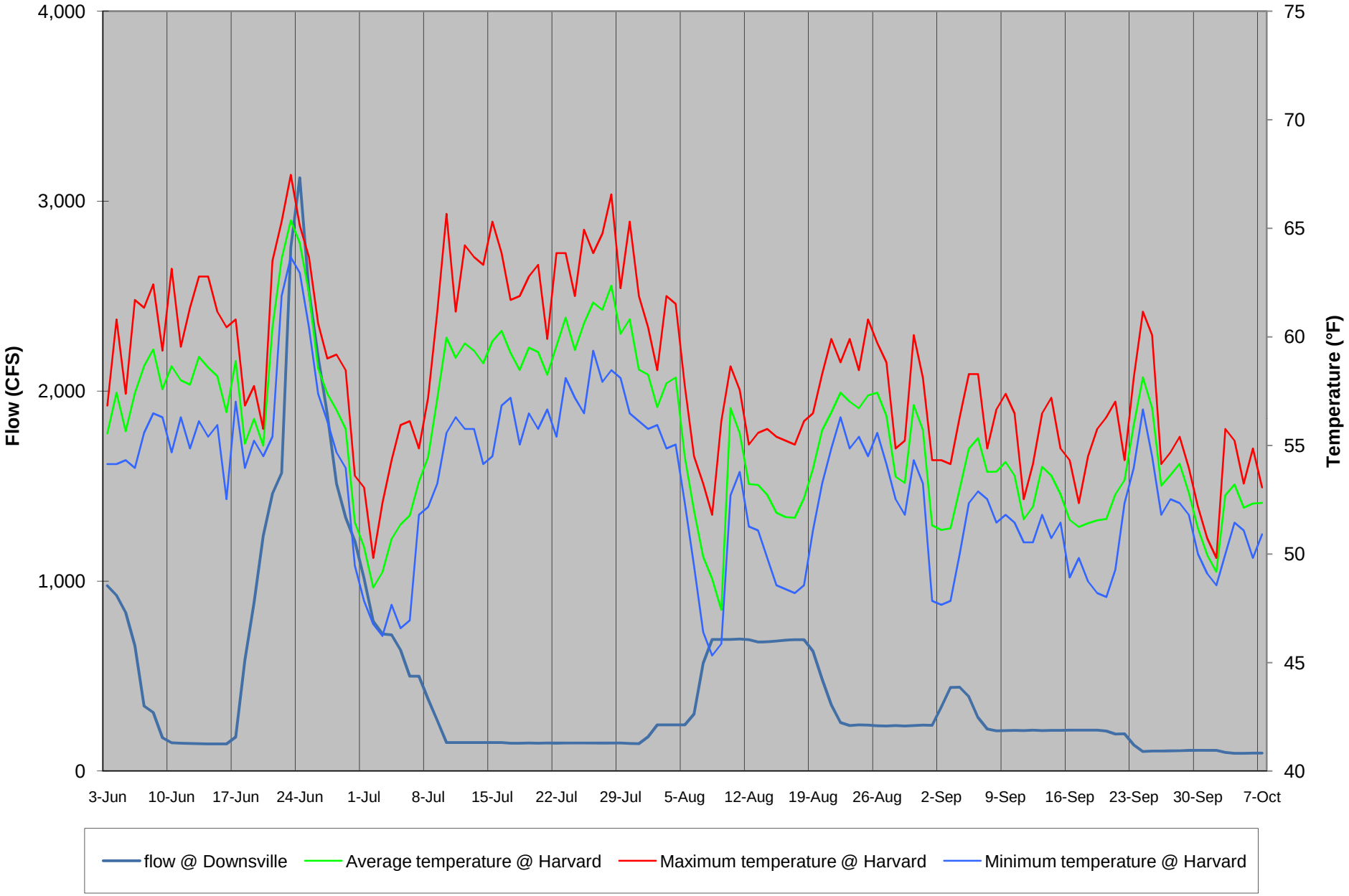
Appendix 2N. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Deutch's Flat, along with daily average flows at Downsville, 2009.



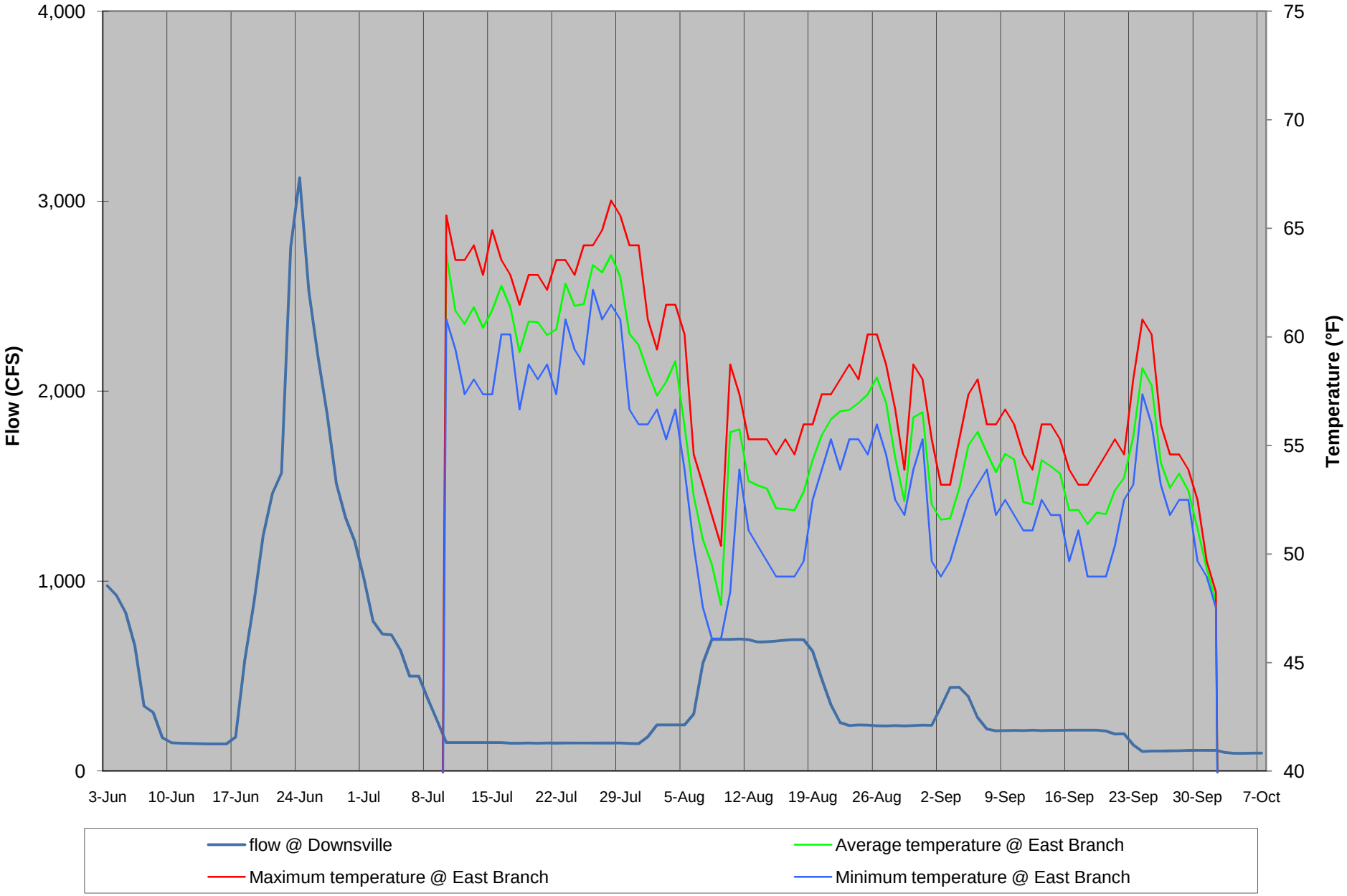
Appendix 2O. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Harvard, along with daily average flows at Downsville, 2009.



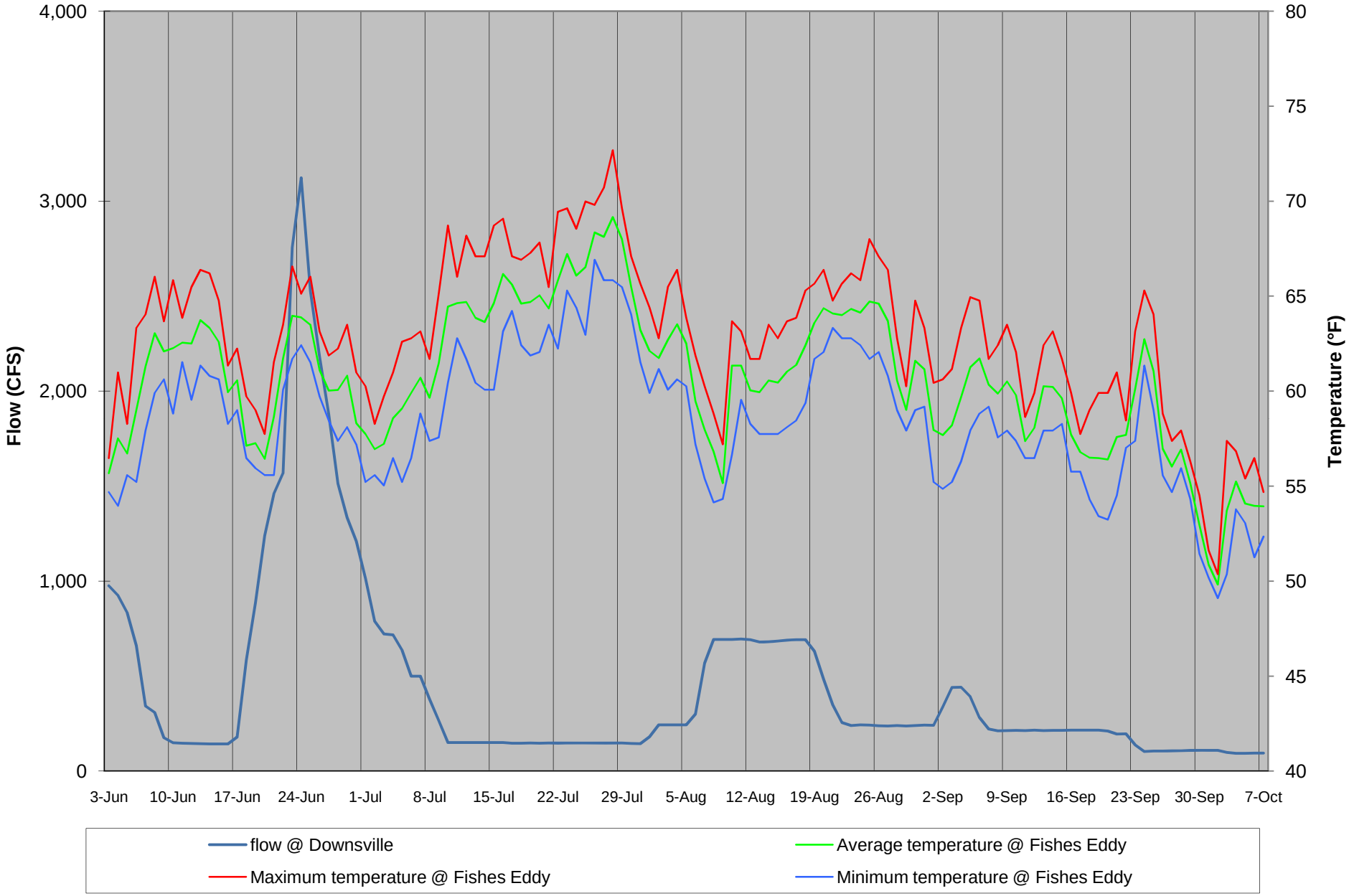
Appendix 2P. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the East Branch at Harvard, along with daily average flows at Downsville, 2009.



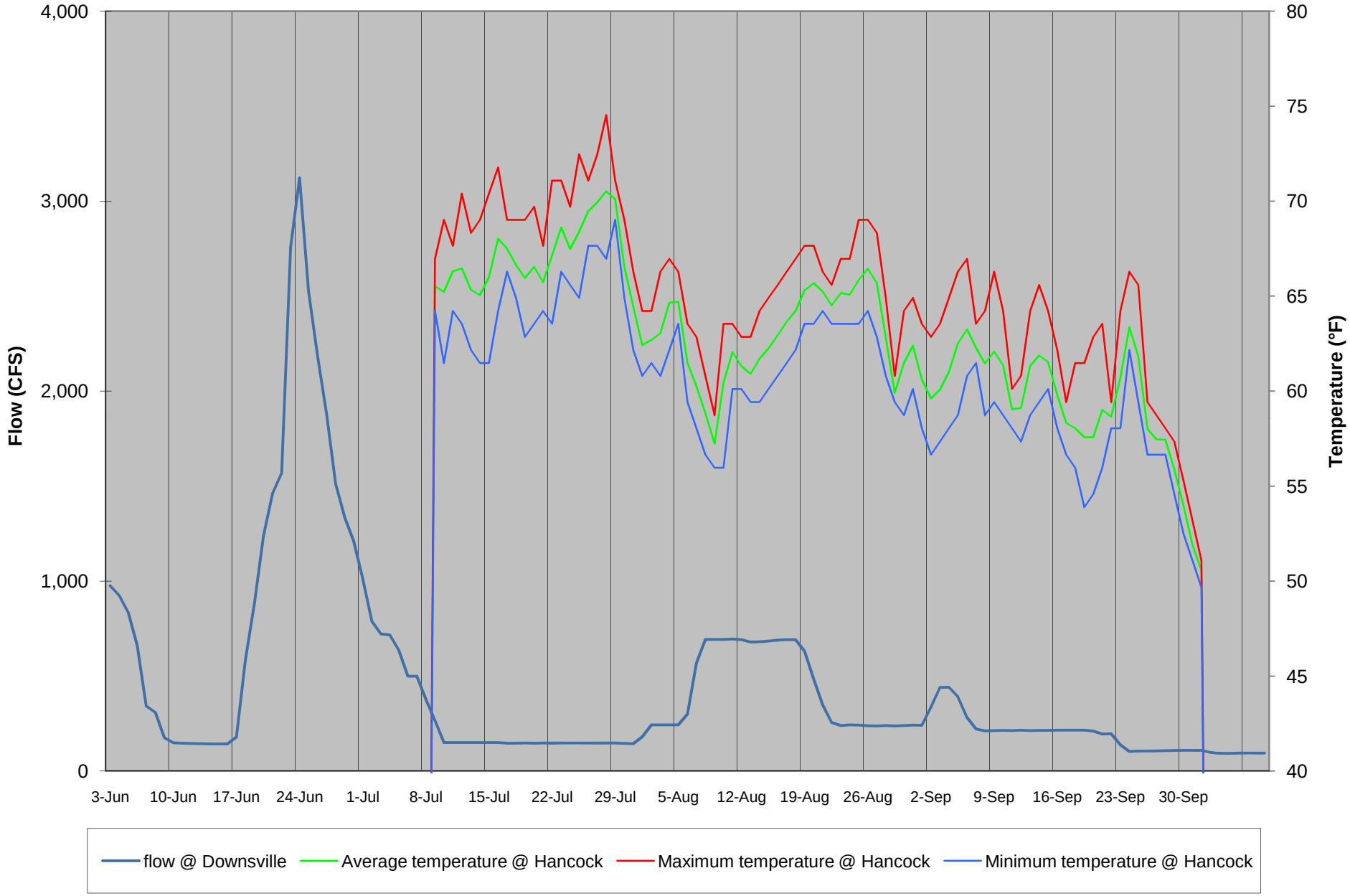
Appendix 2Q. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at East Branch, along with daily average flows at Downsville, 2009.



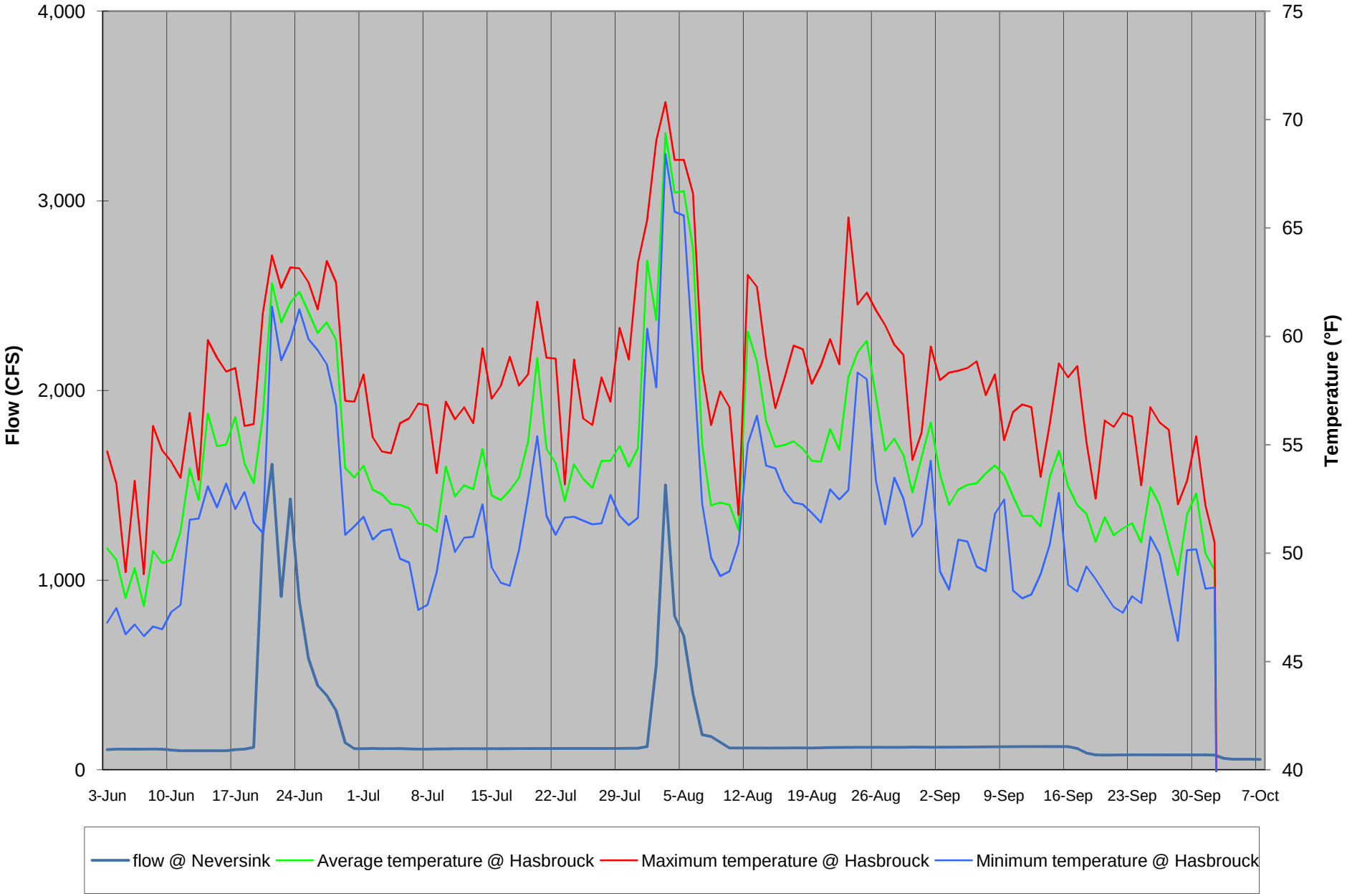
Appendix 2R. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the East Branch at Fishs Eddy, along with daily average flows at Downsville, 2009.



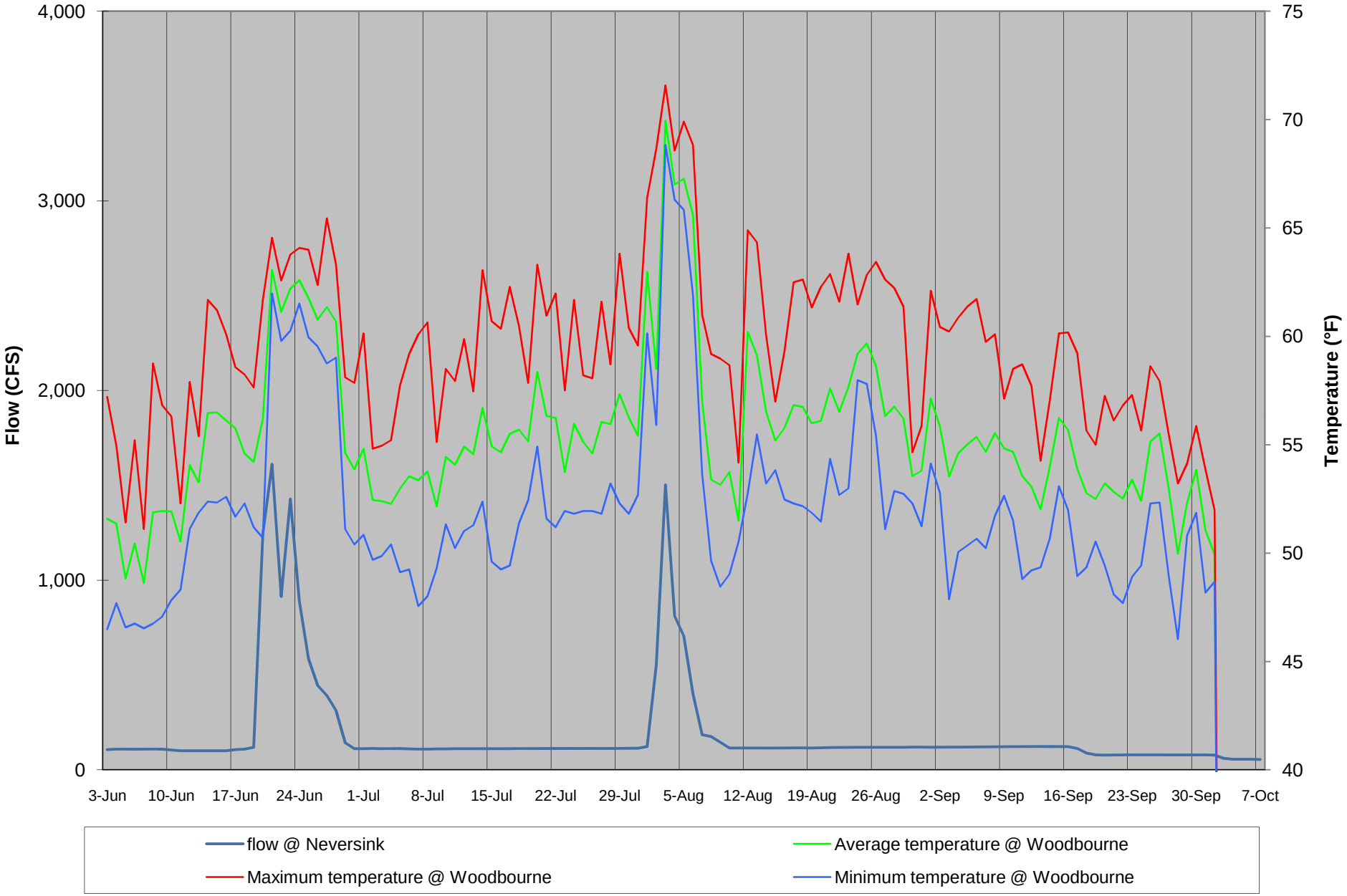
Appendix 2S. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Hancock, along with daily average flows at Downsville, 2009.



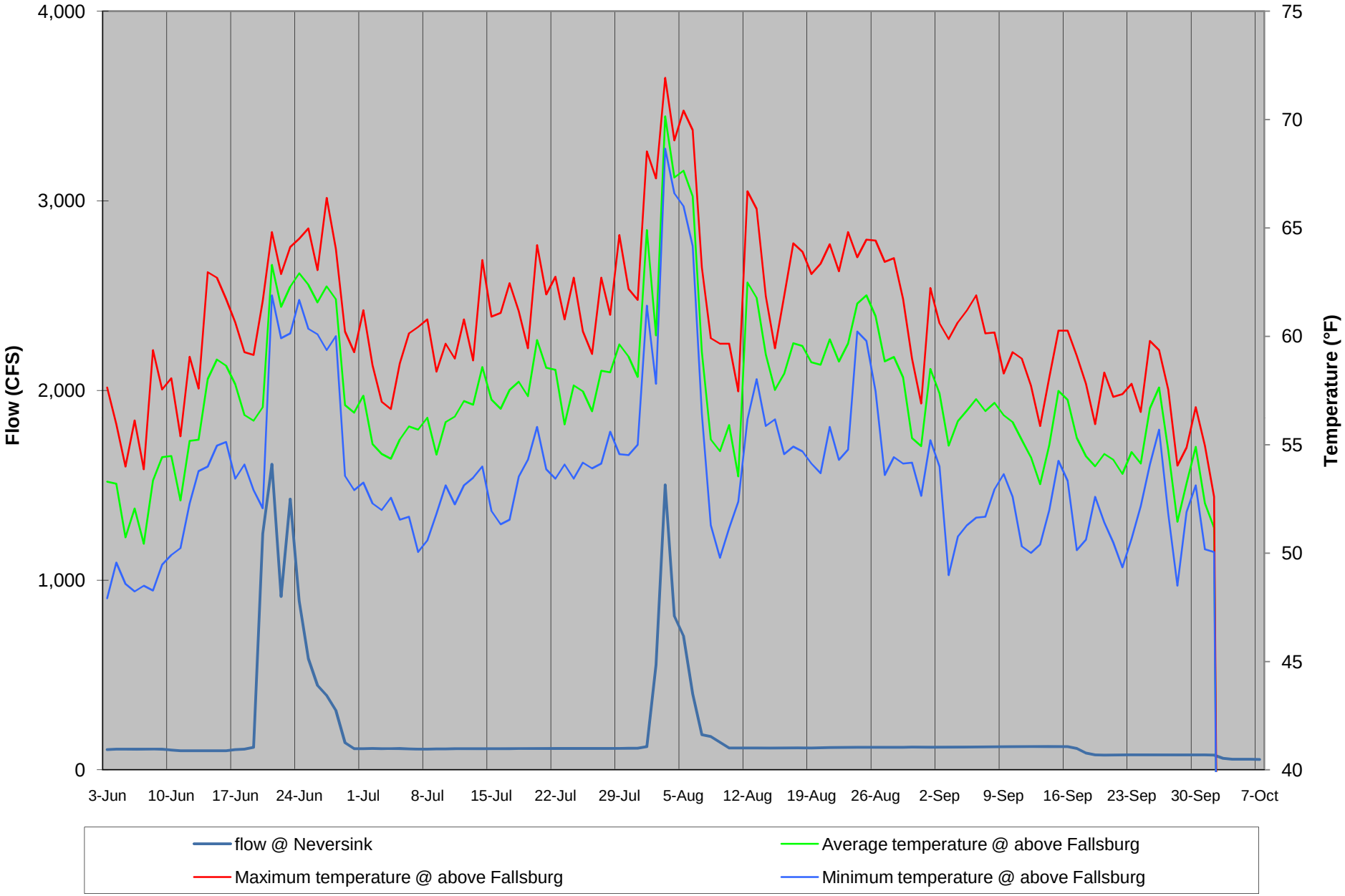
Appendix 2T. Summer daily average, maximum, and minimum water temperature profiles on the Neversink at Hasbrouck, along with daily average flows at Neversink, 2009.



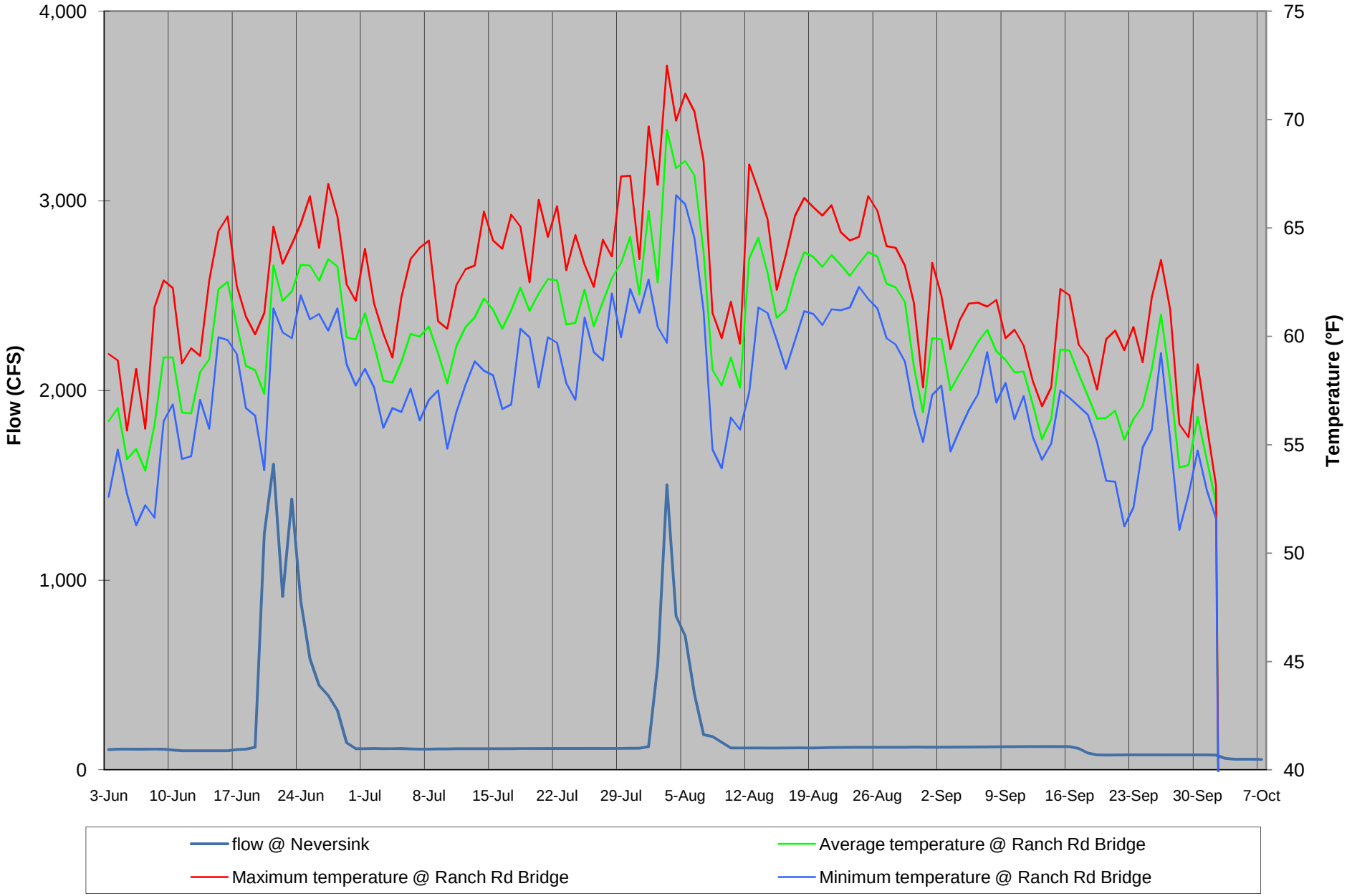
Appendix 2U. Summer daily average, maximum, and minimum water temperature profiles on the Neversink at Woodbourne, along with daily average flows at Neversink, 2009.



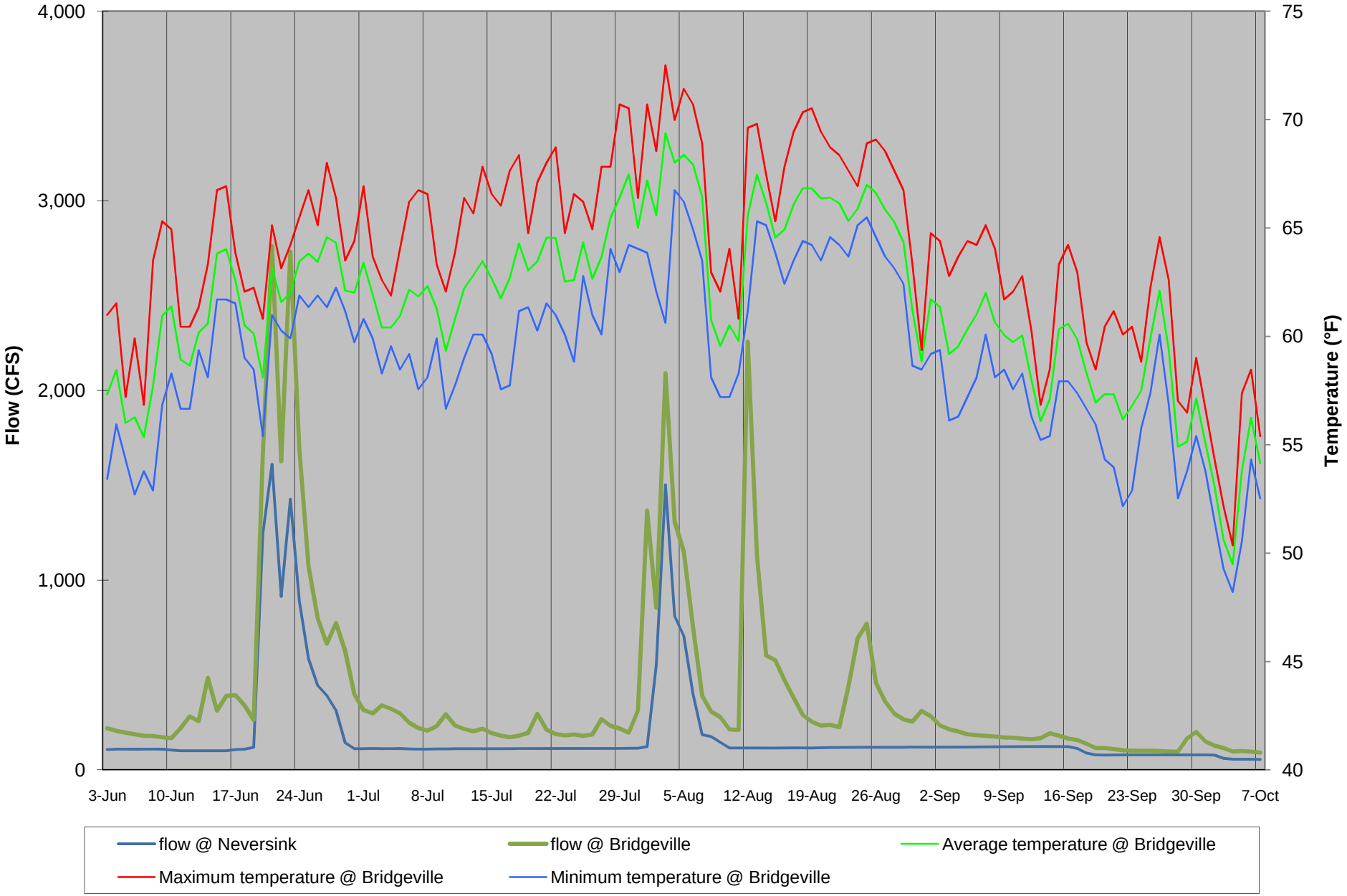
Appendix 2V. Summer daily average, maximum, and minimum water temperature profiles on the Neversink just above Fallsburg, along with daily average flows at Neversink, 2009.



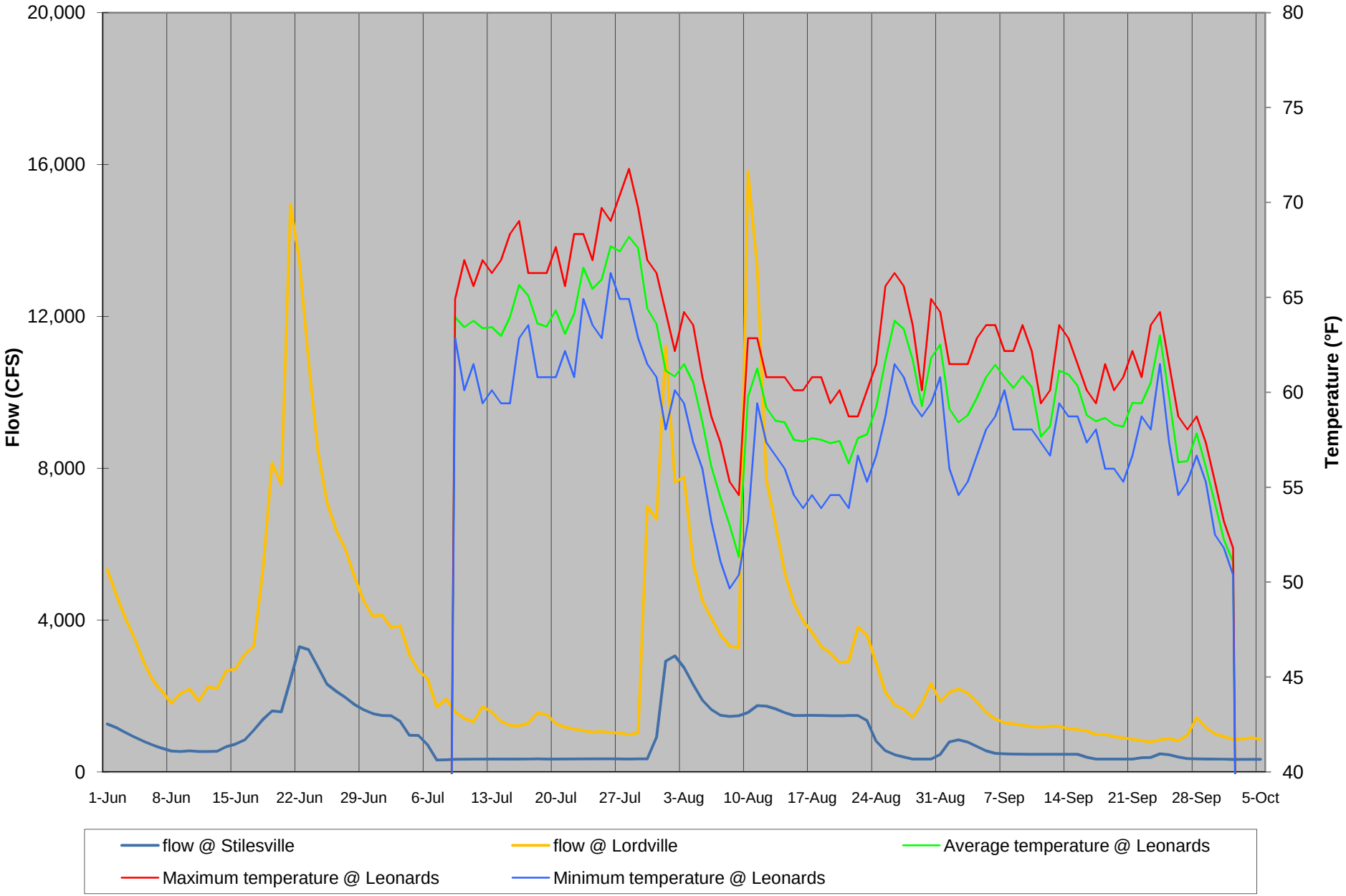
Appendix 2W. Summer daily average, maximum, and minimum water temperature profiles on the Neversink at Ranch Rd bridge, along with daily average flows at Neversink, 2009.



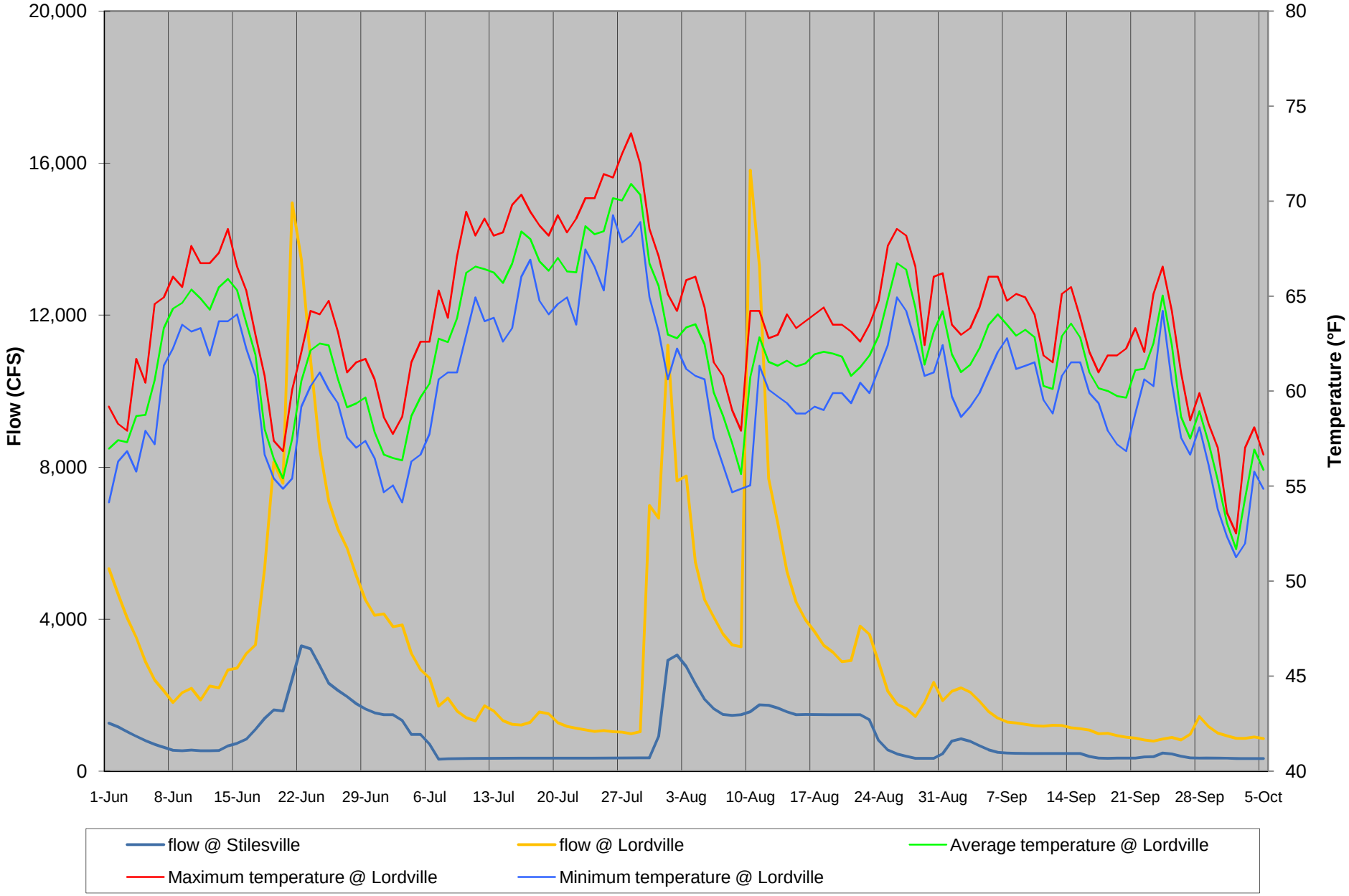
Appendix 2X. Summer daily average, maximum, and minimum water temperature profiles on the Neversink at Bridgeville, along with daily average flows at Bridgeville & Neversink, 2009.



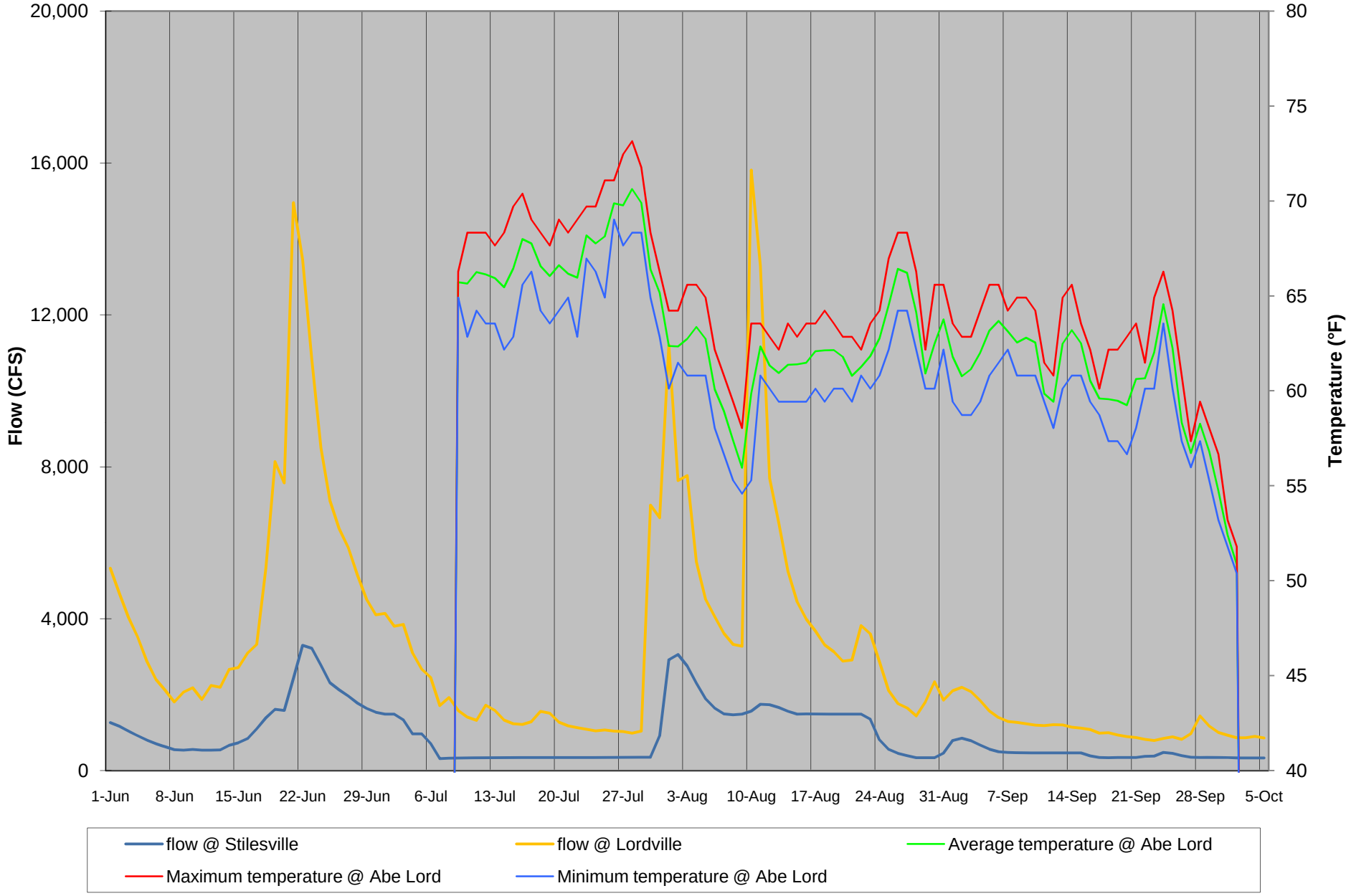
Appendix 2Y. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Leonards, along with daily average flows at Stilesville on the West Branch and Lordville, 2009.



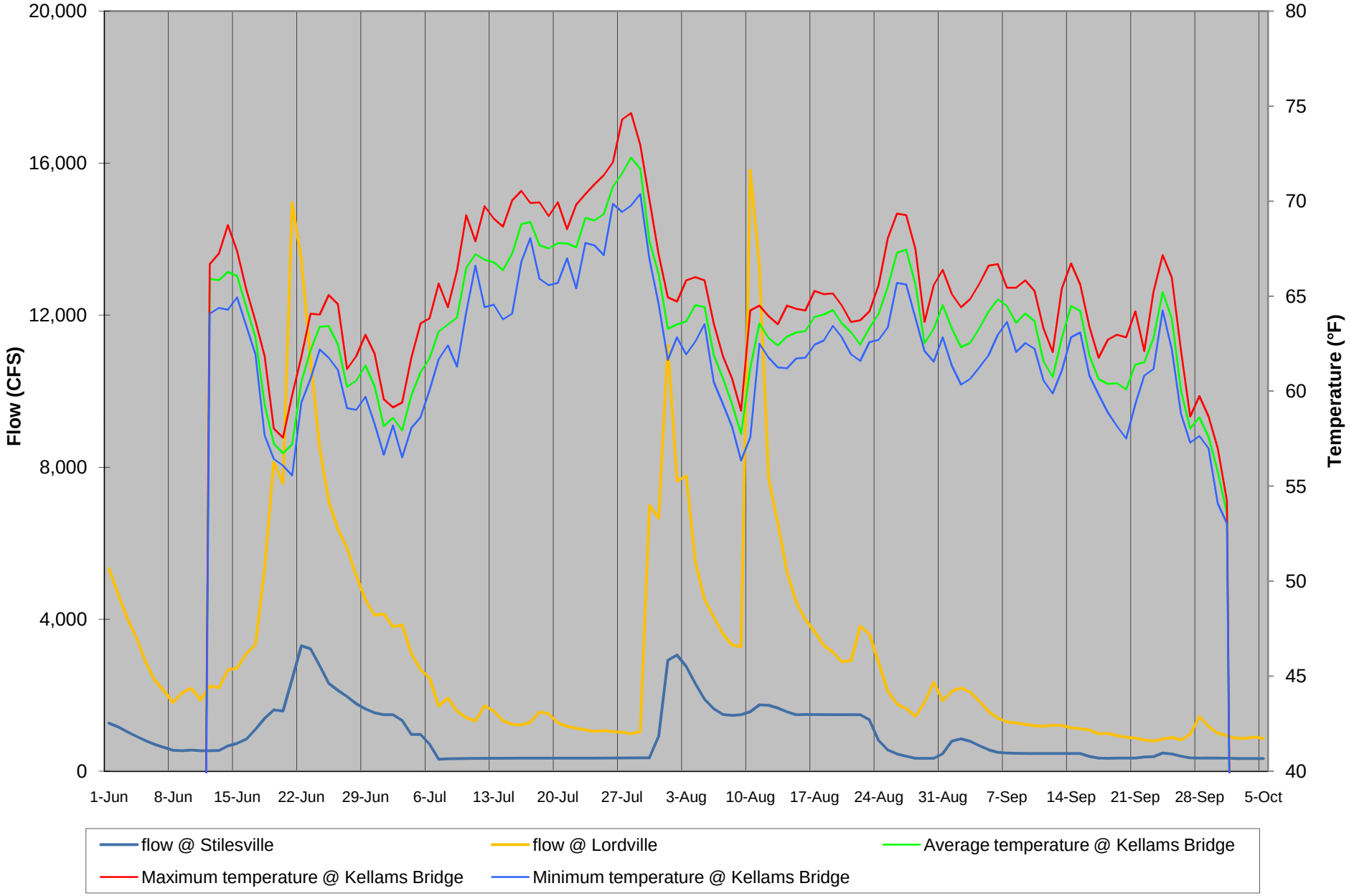
Appendix 2Z. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Lordville, along with daily average flows at Stilesville on the West Branch and Lordville, 2009.



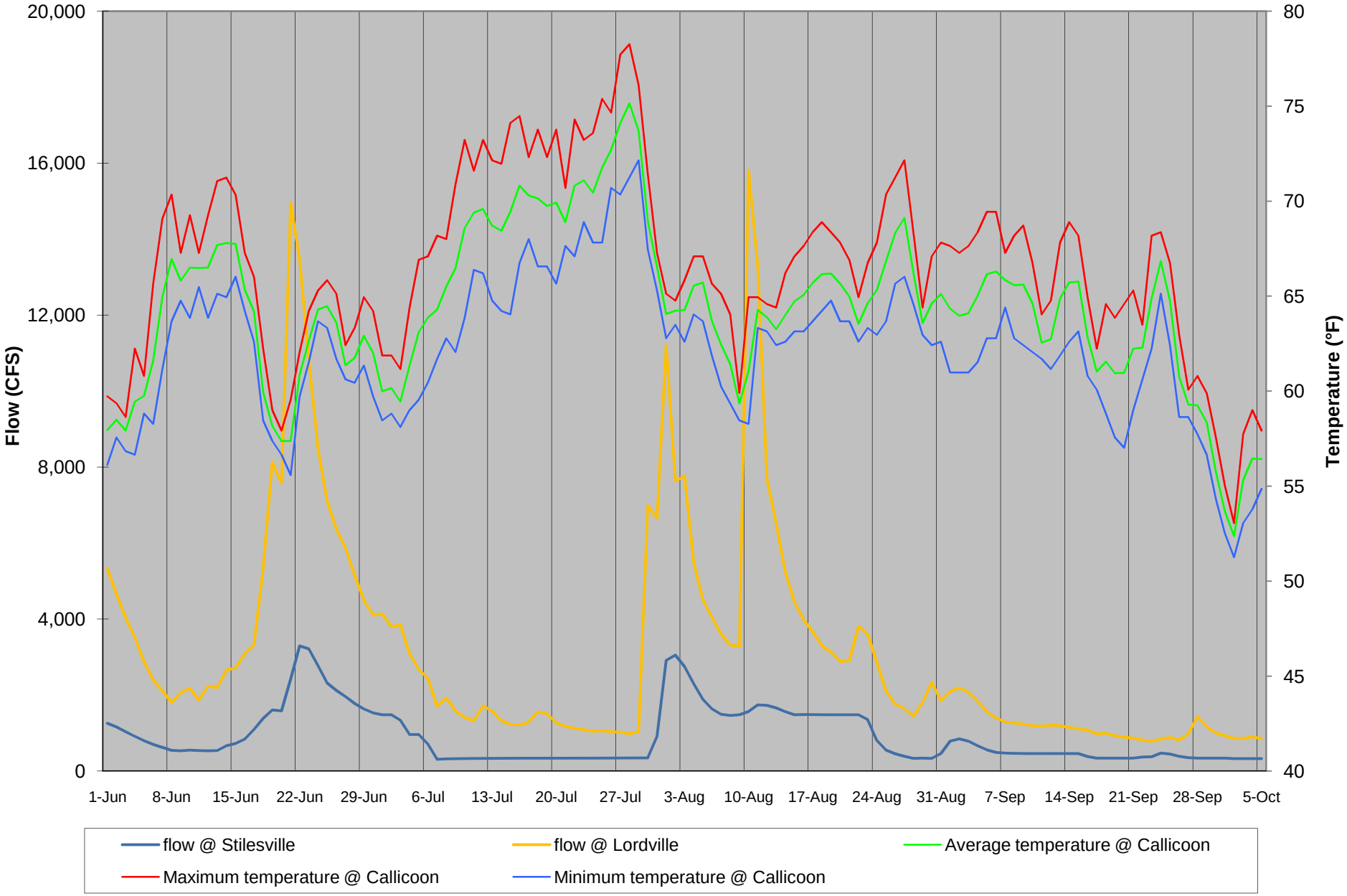
Appendix 2AA. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Abe Lord, along with daily average flows at Stilesville on the West Branch and Lordville, 2009.



Appendix 2BB. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Kellams Bridge, along with daily average flows at Stilesville on the West Branch and Lordville, 2009.



Appendix 2CC. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Callicoon, along with daily average flows at Stilesville on the West Branch and Lordville, 2009.



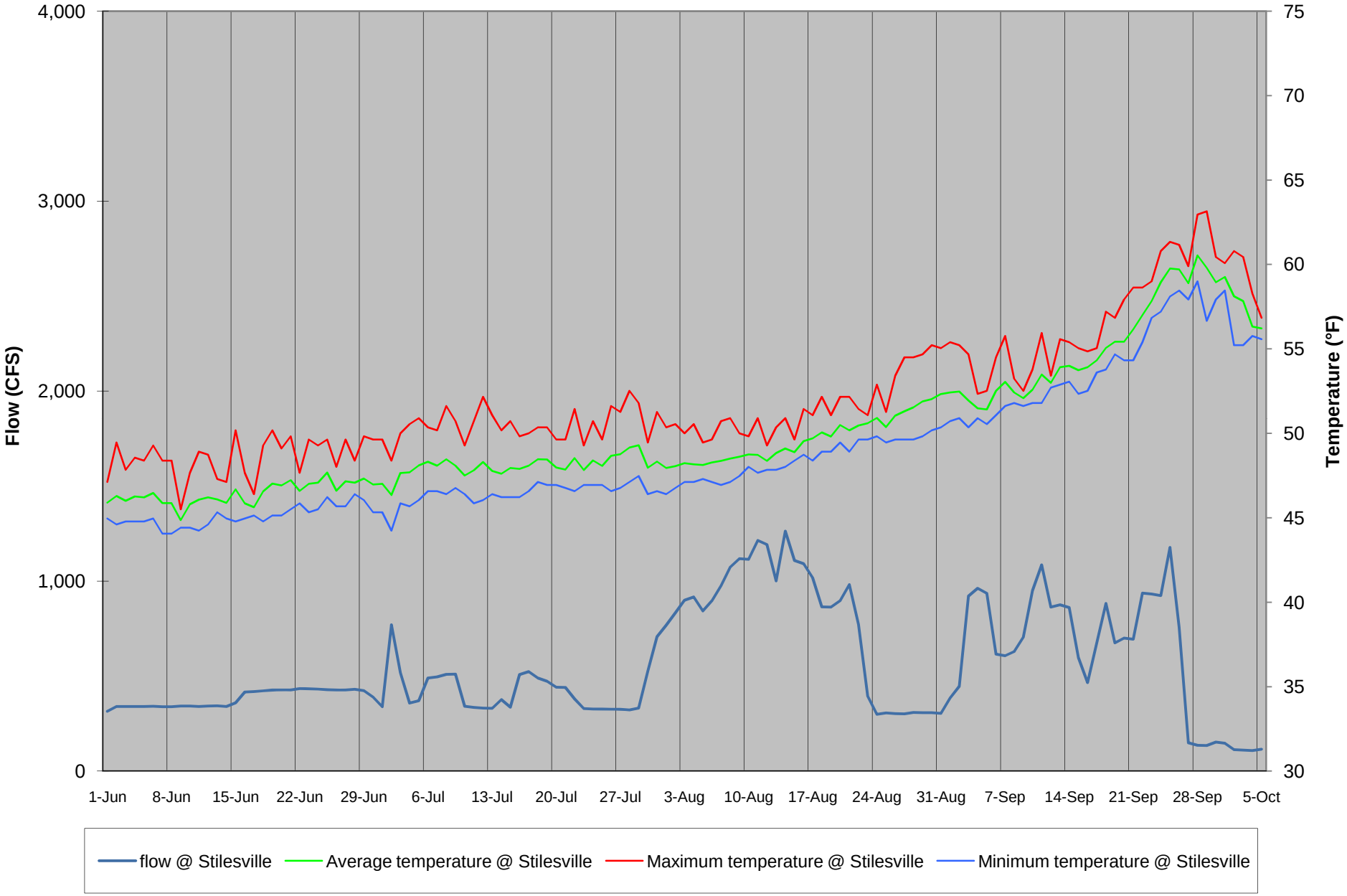
Appendix 3:

UPPER DELAWARE TAILWATERS

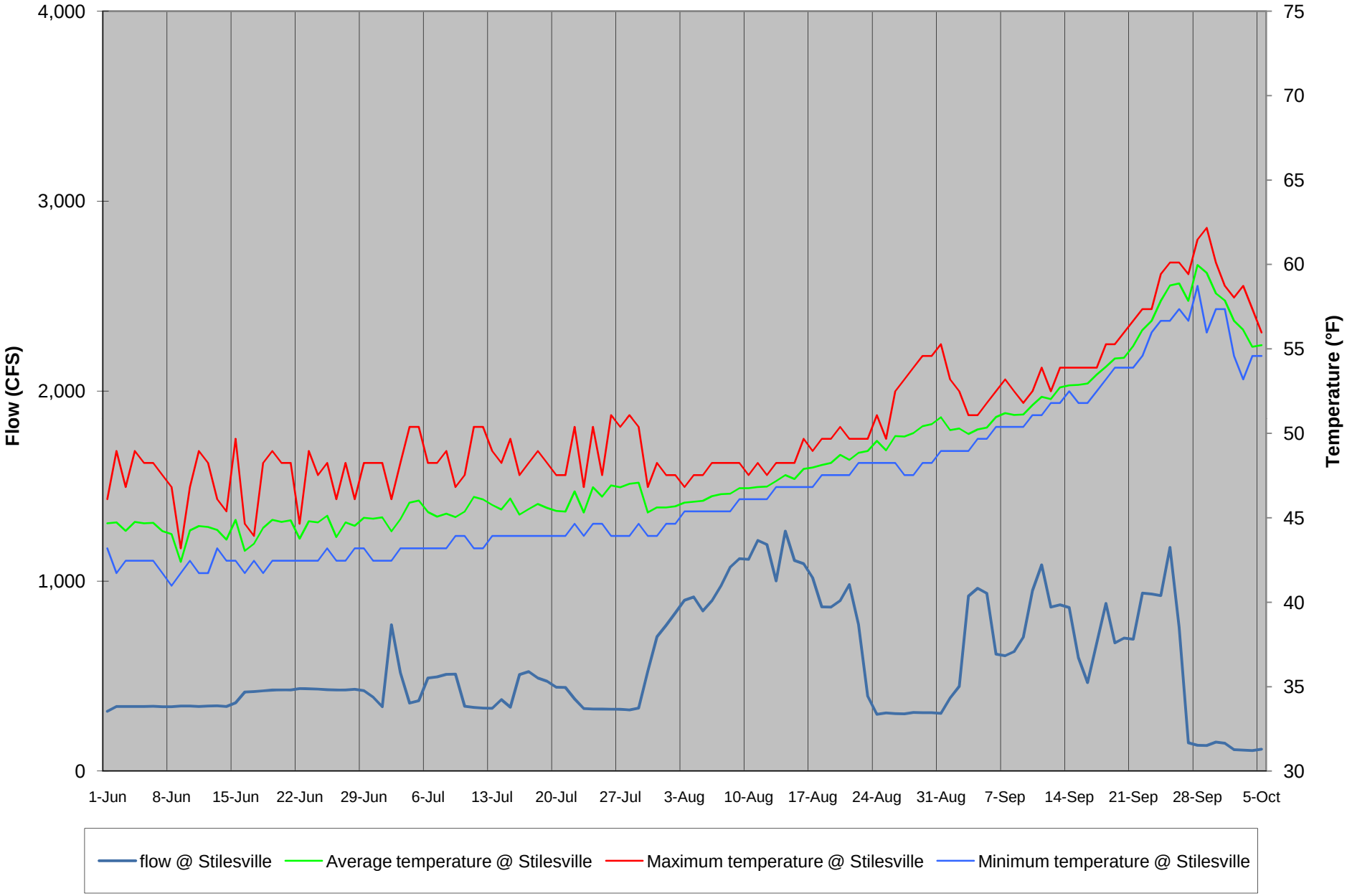
Maxima, minima, and average summer water temperature profile for each temperature monitoring site, 2010

West Branch: Appendices 3A to 3I
East Branch: Appendices 3J to 3Q
Neversink River: Appendices 3R to 3V
Delaware River: Appendices 3W to 3AA

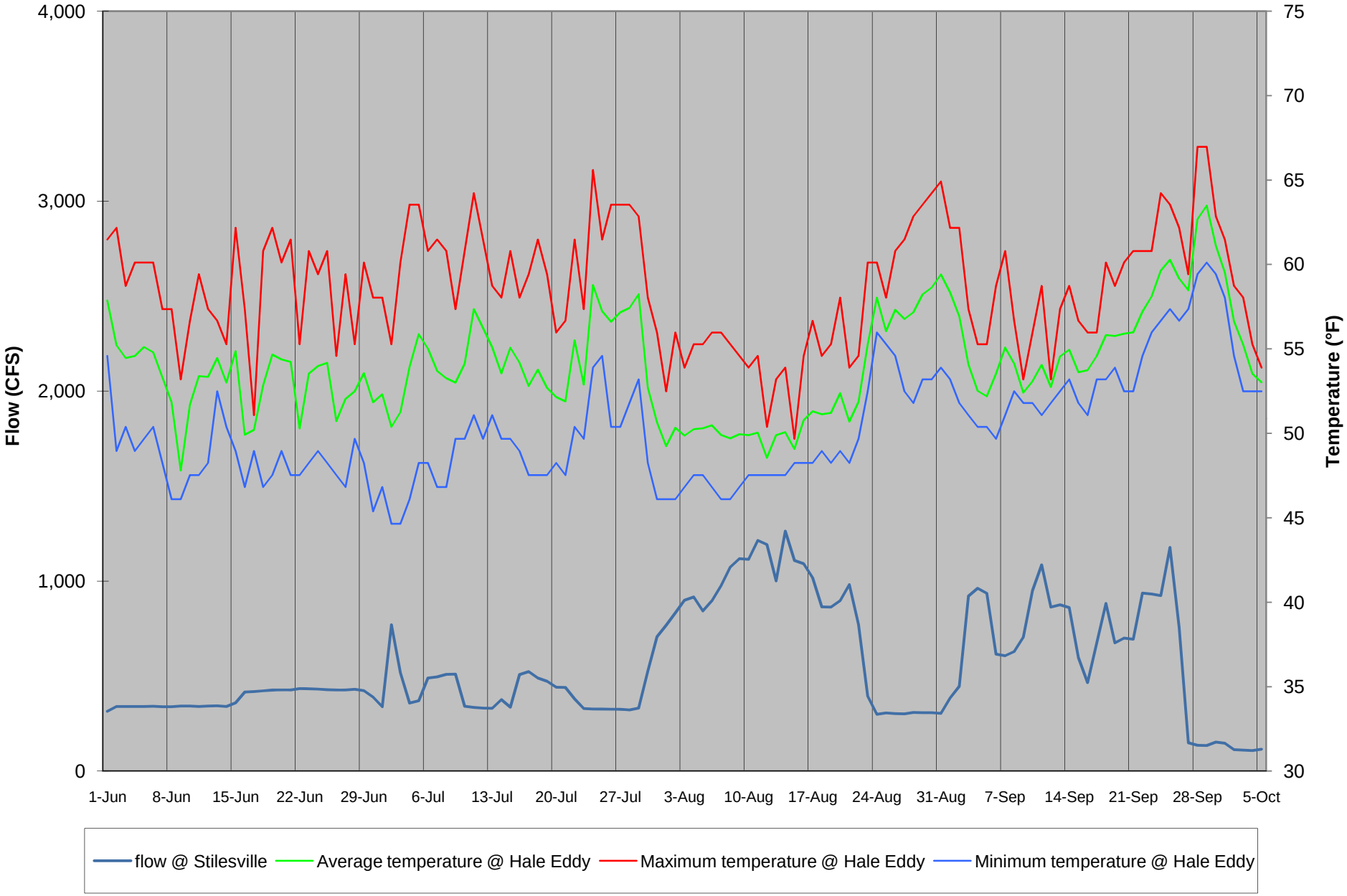
Appendix 3A. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the West Branch at Stilesville, along with daily average flows at Stilesville, 2010.



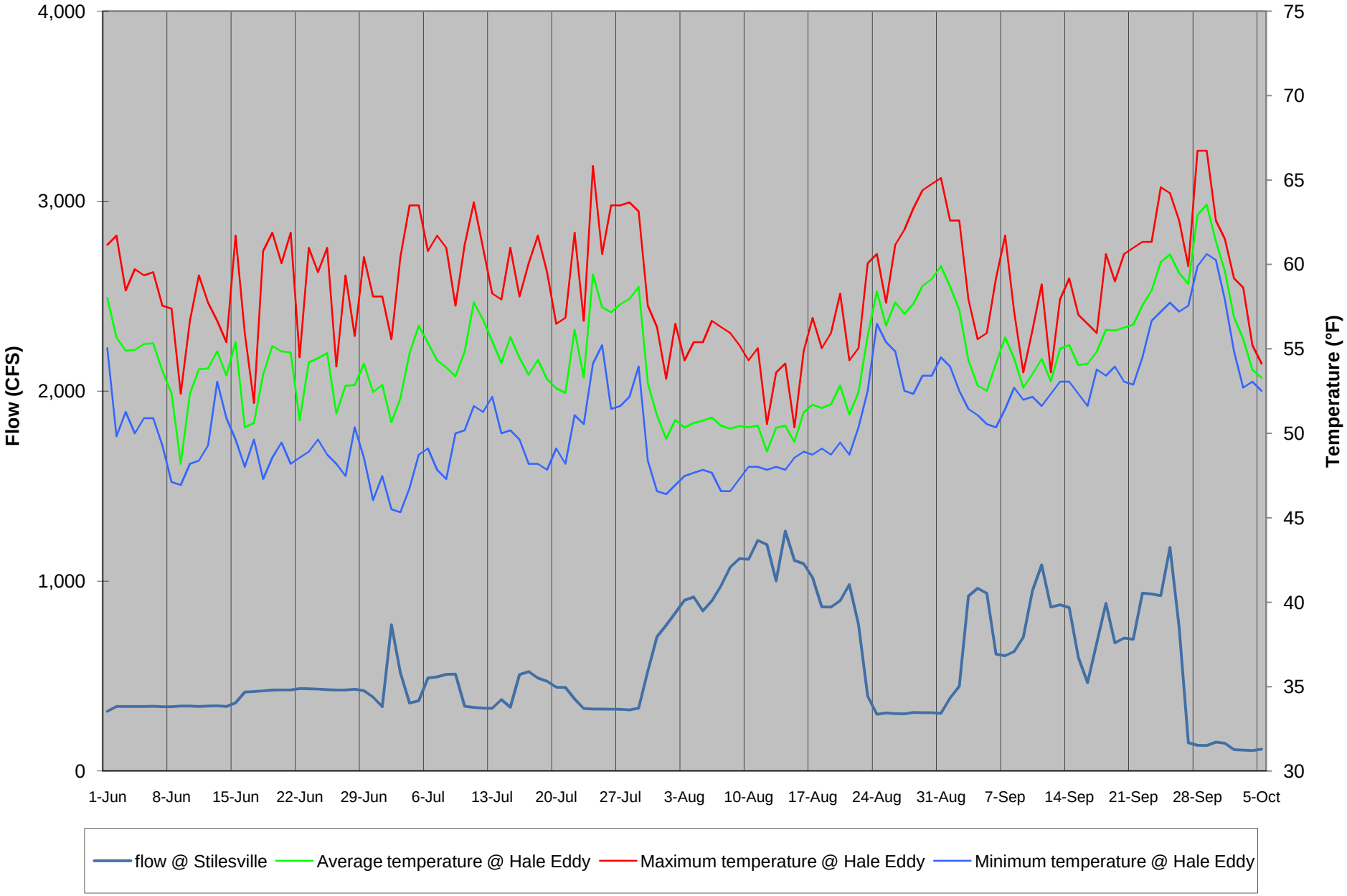
Appendix 3B. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Stilesville, along with daily average flows at Stilesville, 2010.



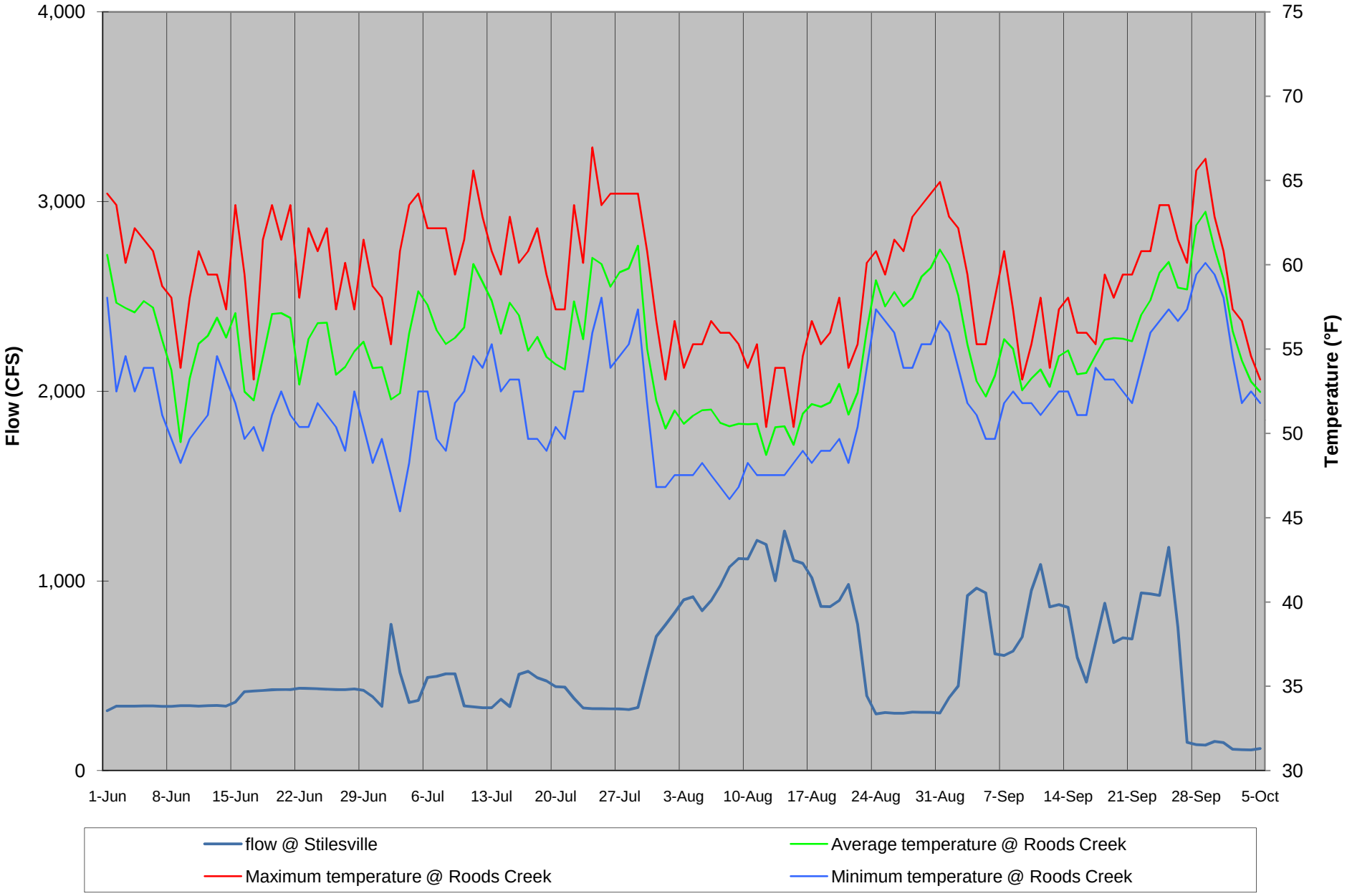
Appendix 3C. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Hale Eddy, along with daily average flows at Stilesville, 2010.



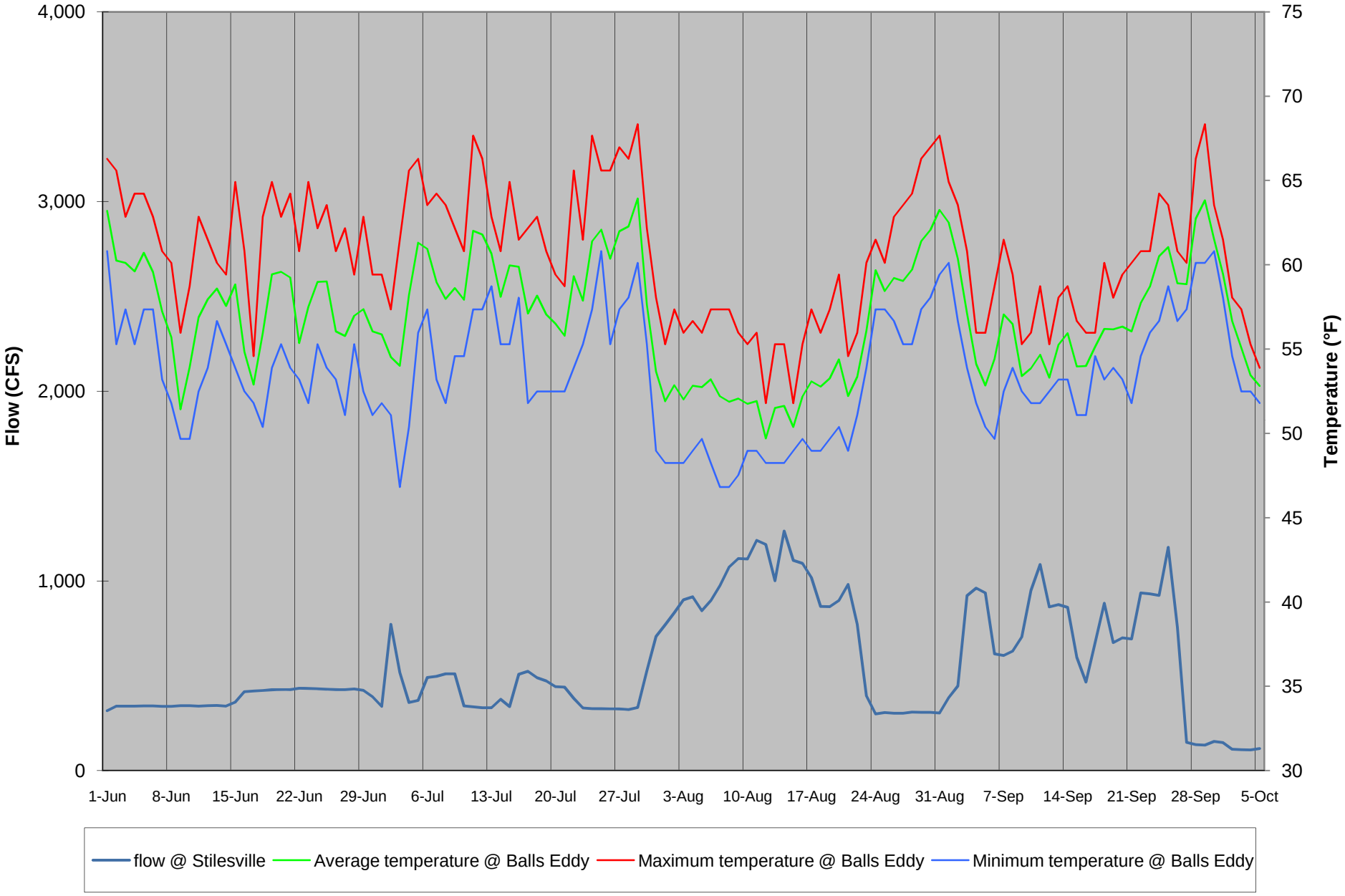
Appendix 3D. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the West Branch at Hale Eddy, along with daily average flows at Stilesville, 2010.



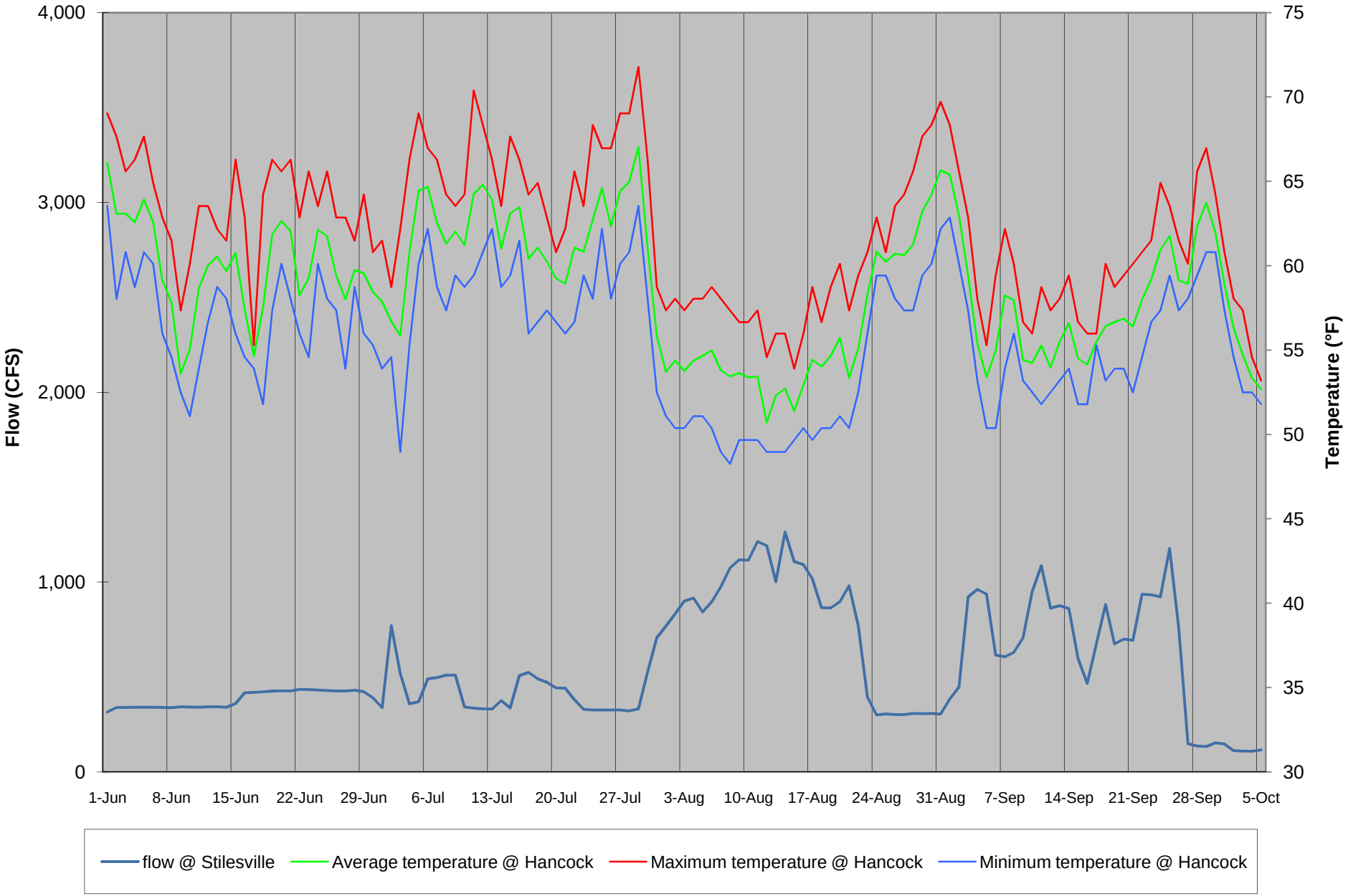
Appendix 3E. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Roods Creek, along with daily average flows at Stilesville, 2010.



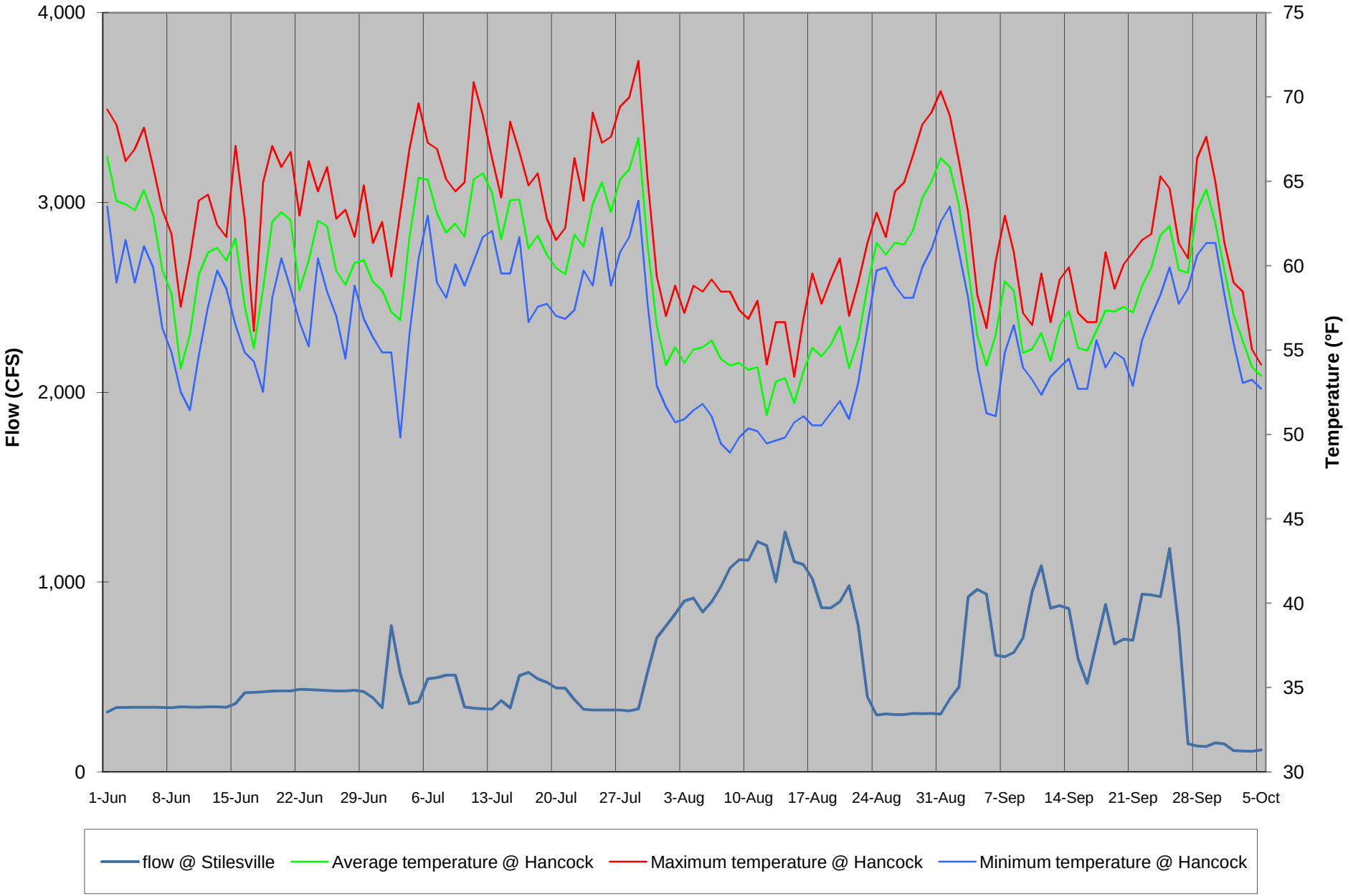
Appendix 3F. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Balls Eddy, along with daily average flows at Stilesville, 2010.



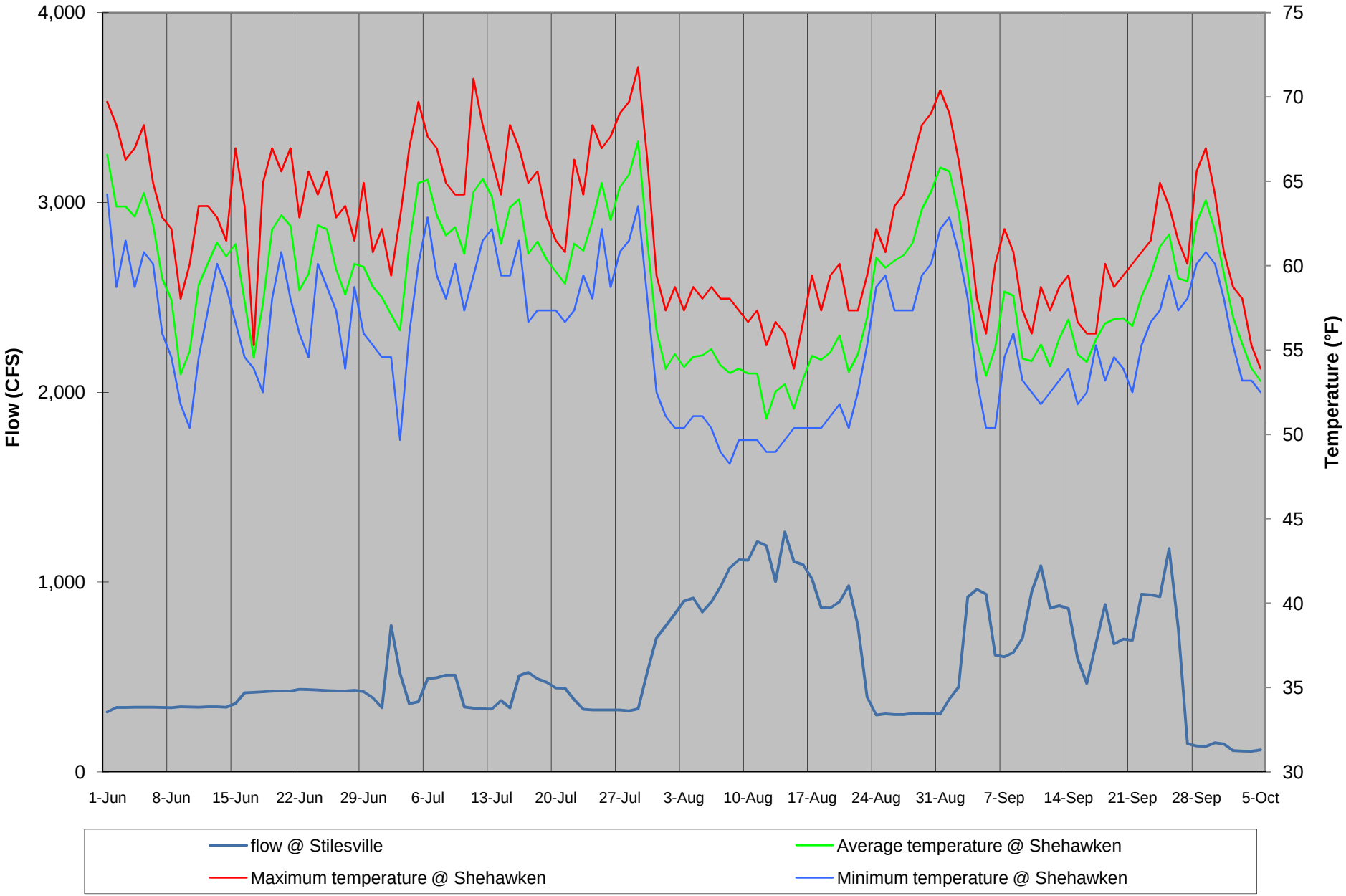
Appendix 3G. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Hancock, along with daily average flows at Stilesville, 2010.



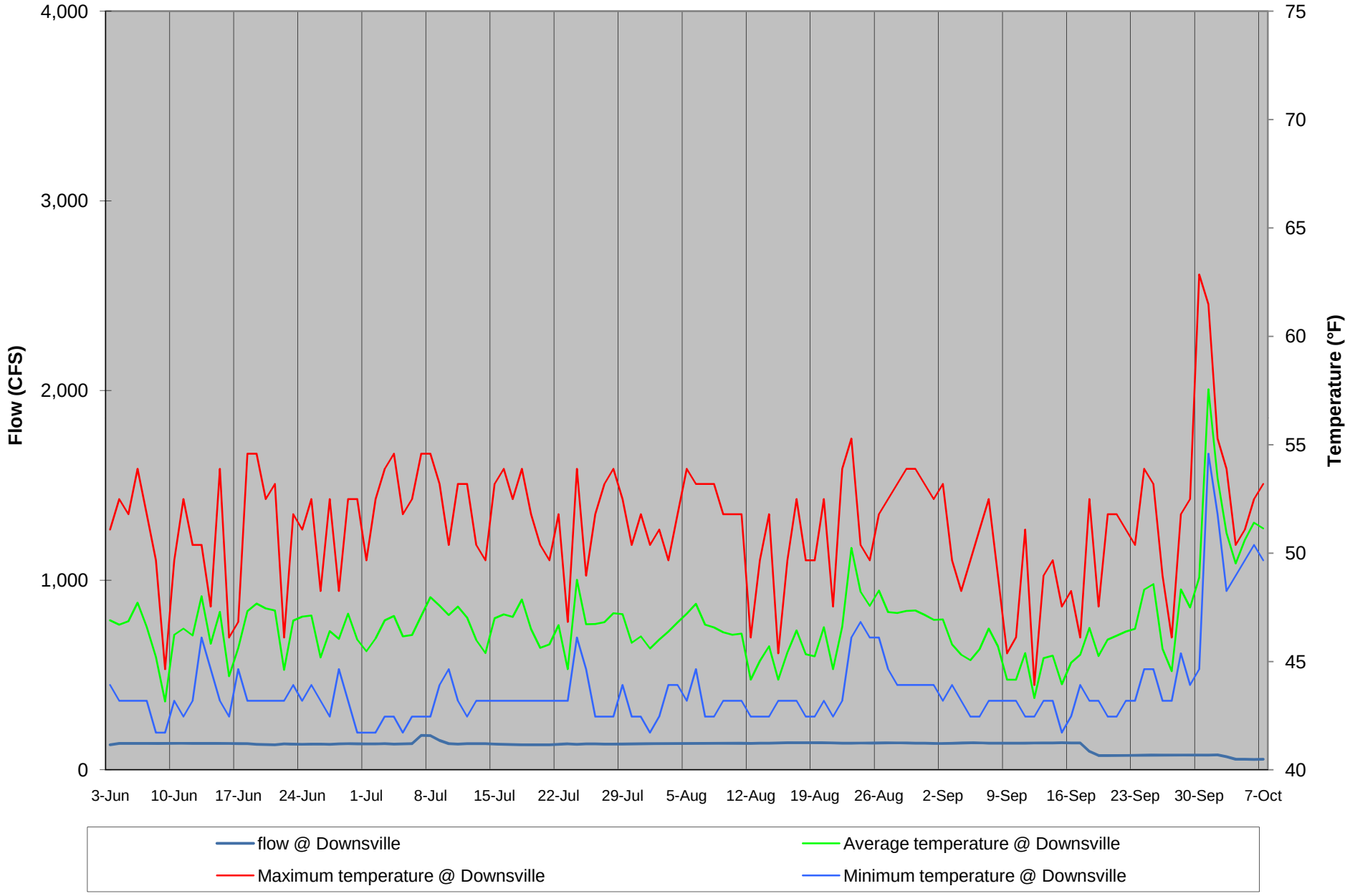
Appendix 3H. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the West Branch at Hancock, along with daily average flows at Stilesville, 2010.



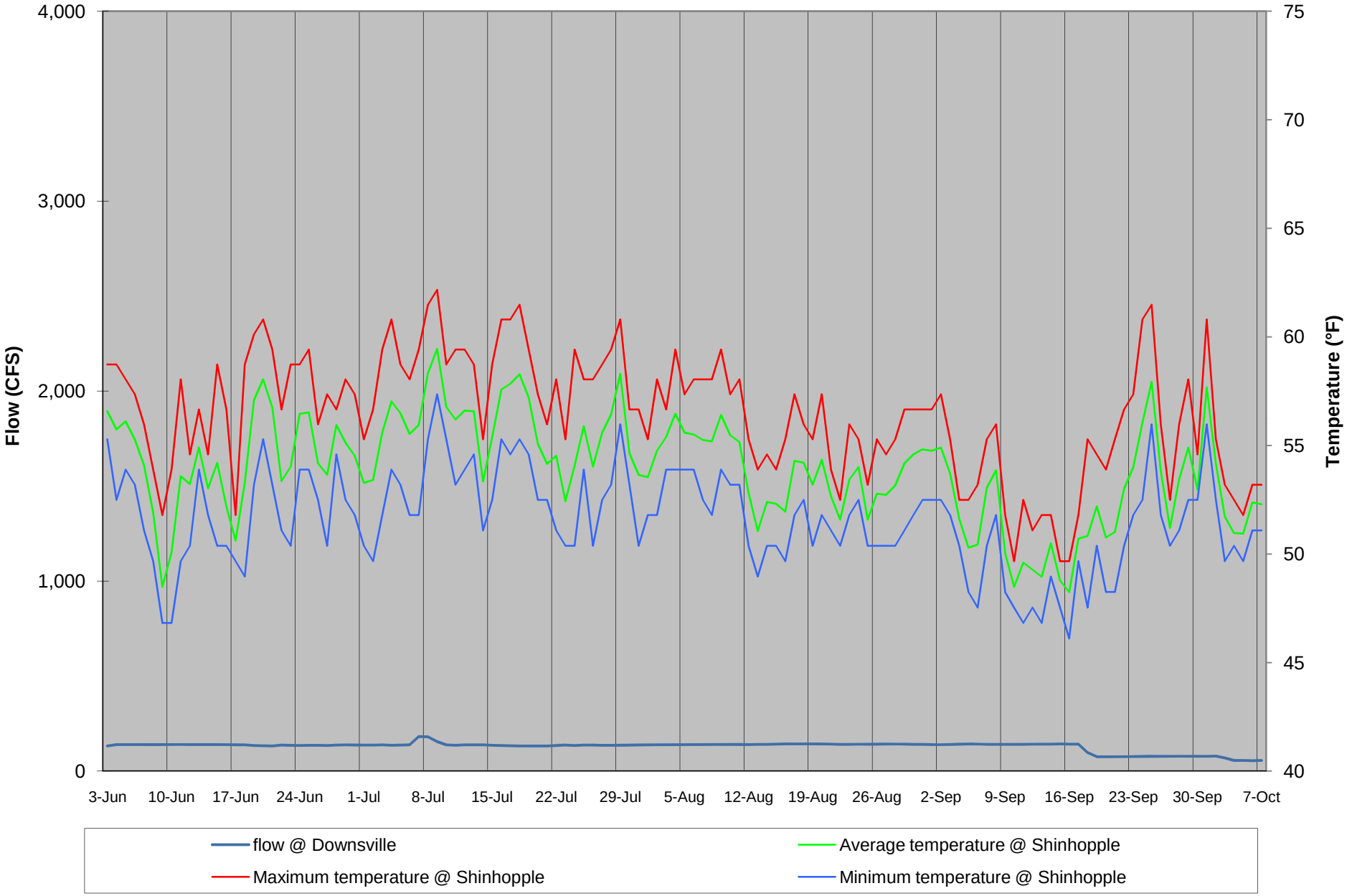
Appendix 3I. Summer daily average, maximum, and minimum water temperature profiles on the West Branch at Shehawken, along with daily average flows at Stilesville, 2010.



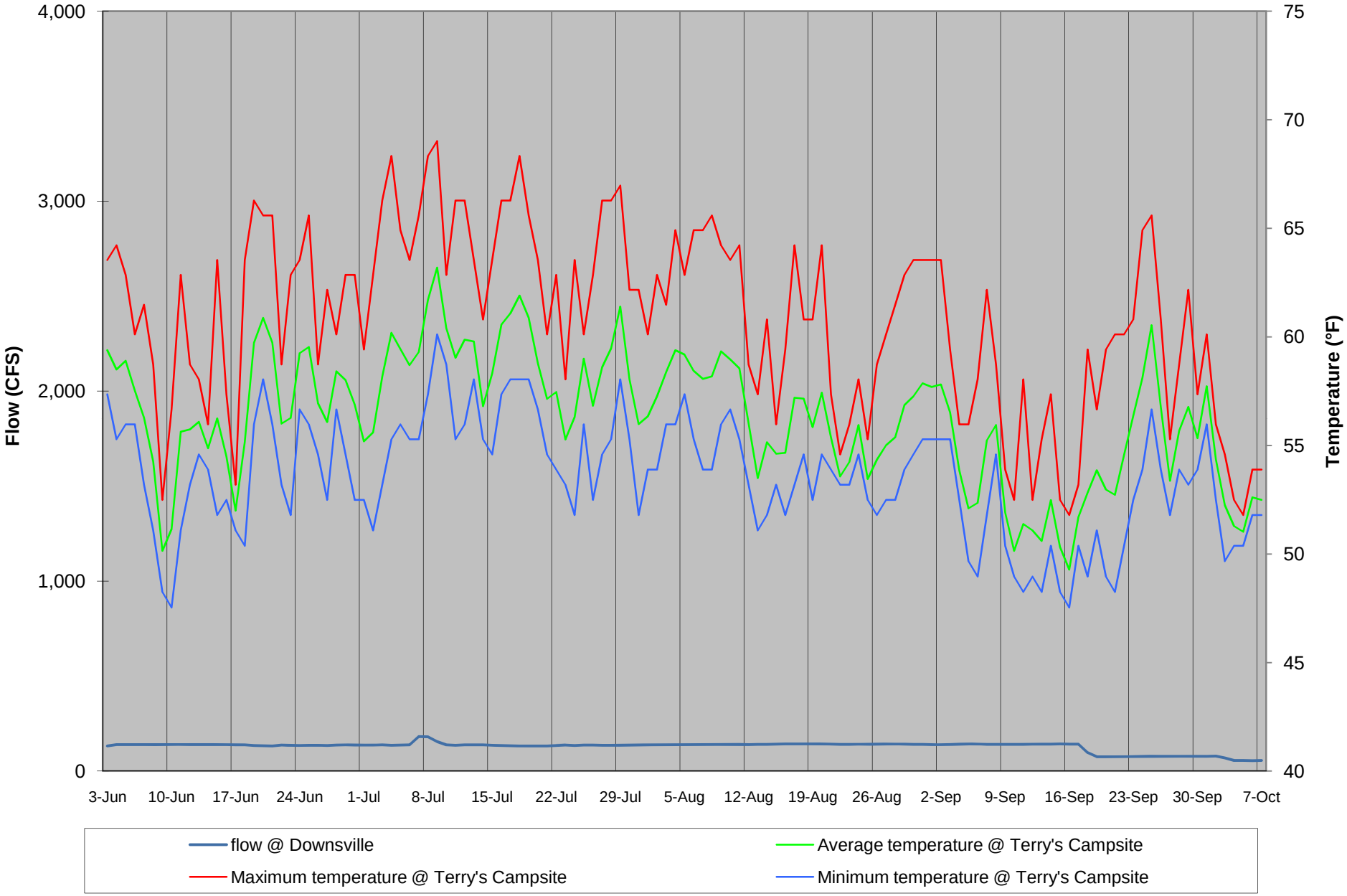
Appendix 3J. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Downsville, along with daily average flows at Downsville, 2010.



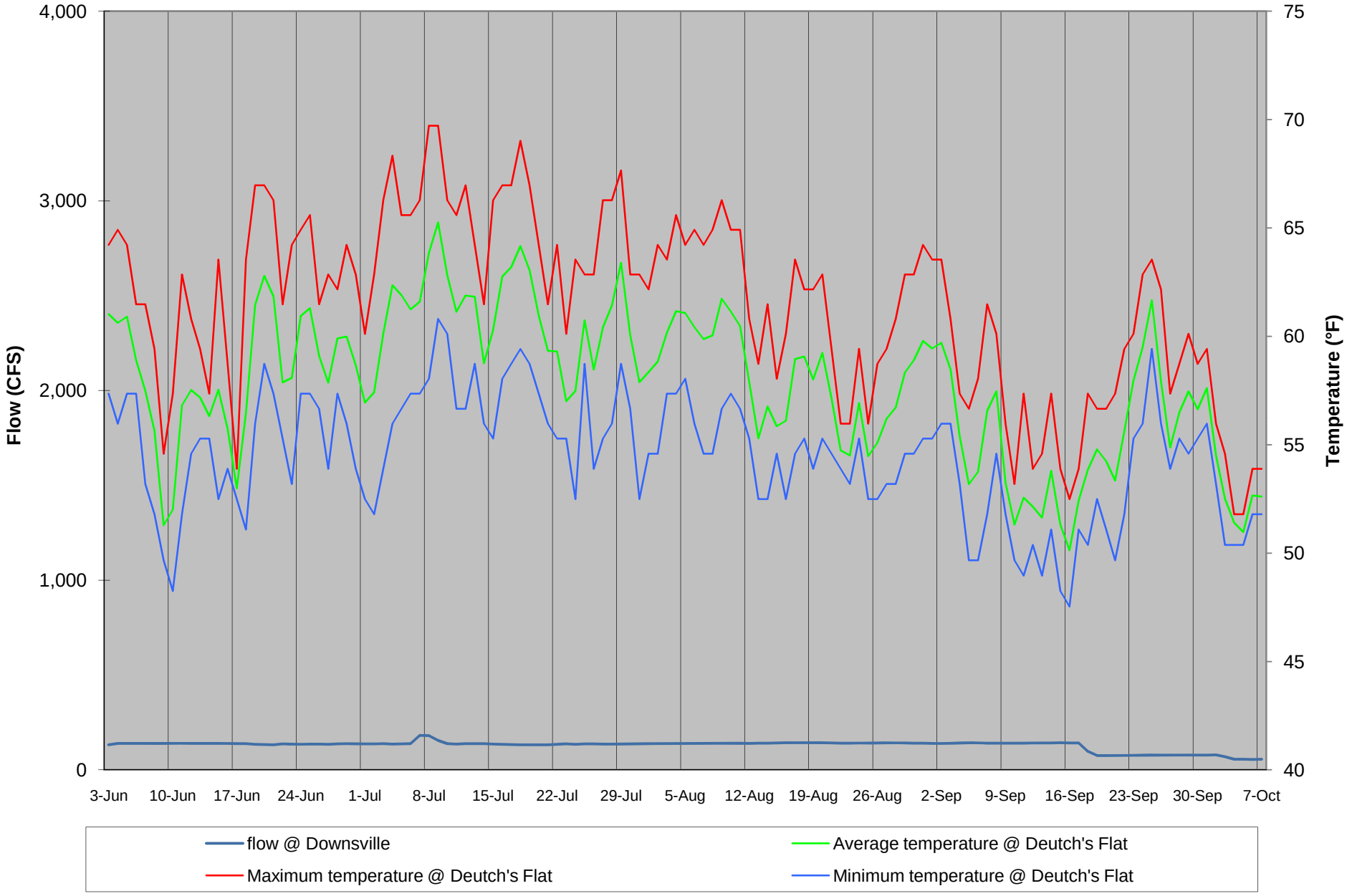
Appendix 3K. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Shinhopple, along with daily average flows at Downsville, 2010.



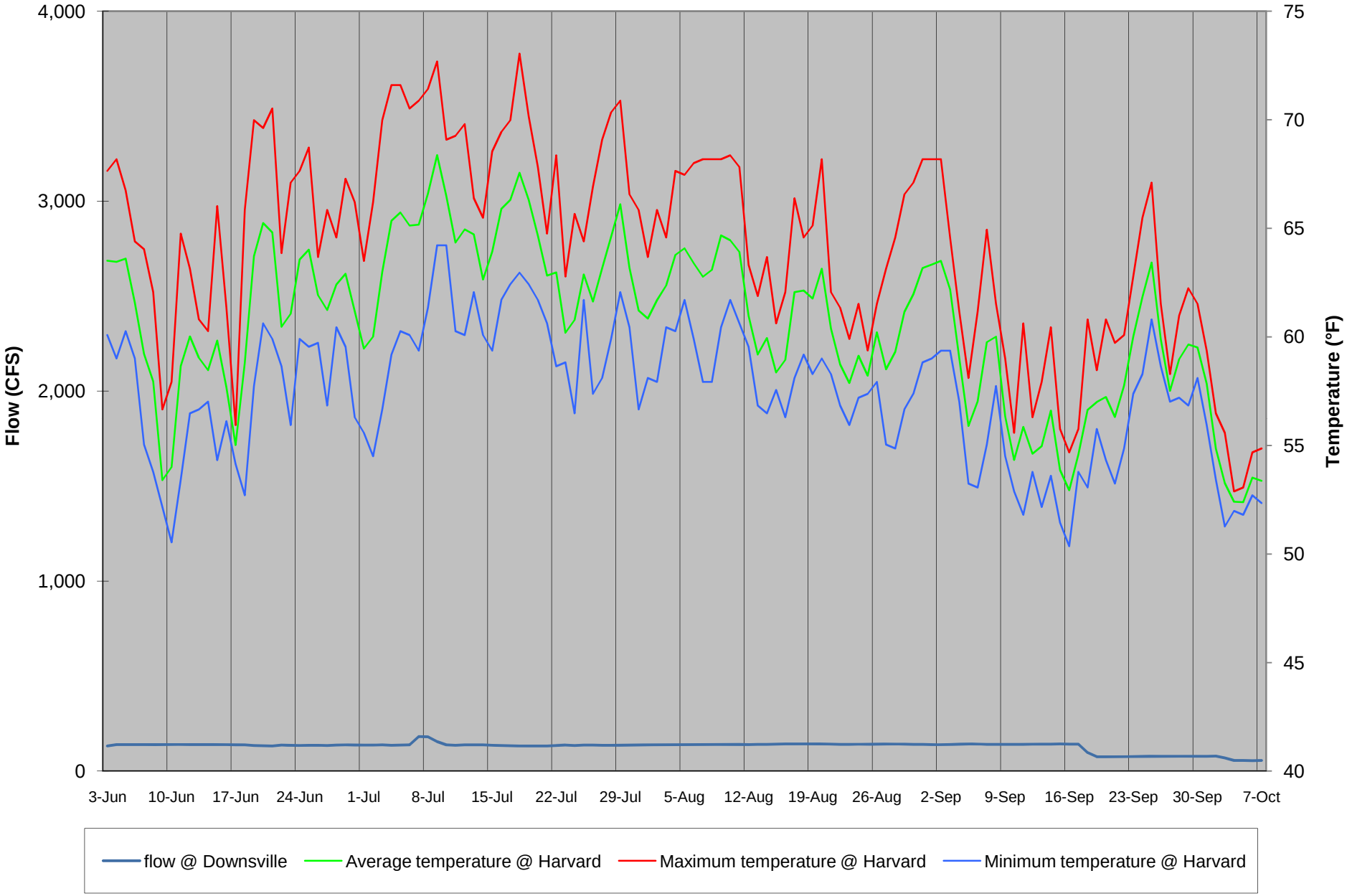
Appendix 3L. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Terry's Campsite, along with daily average flows at Downsville, 2010.



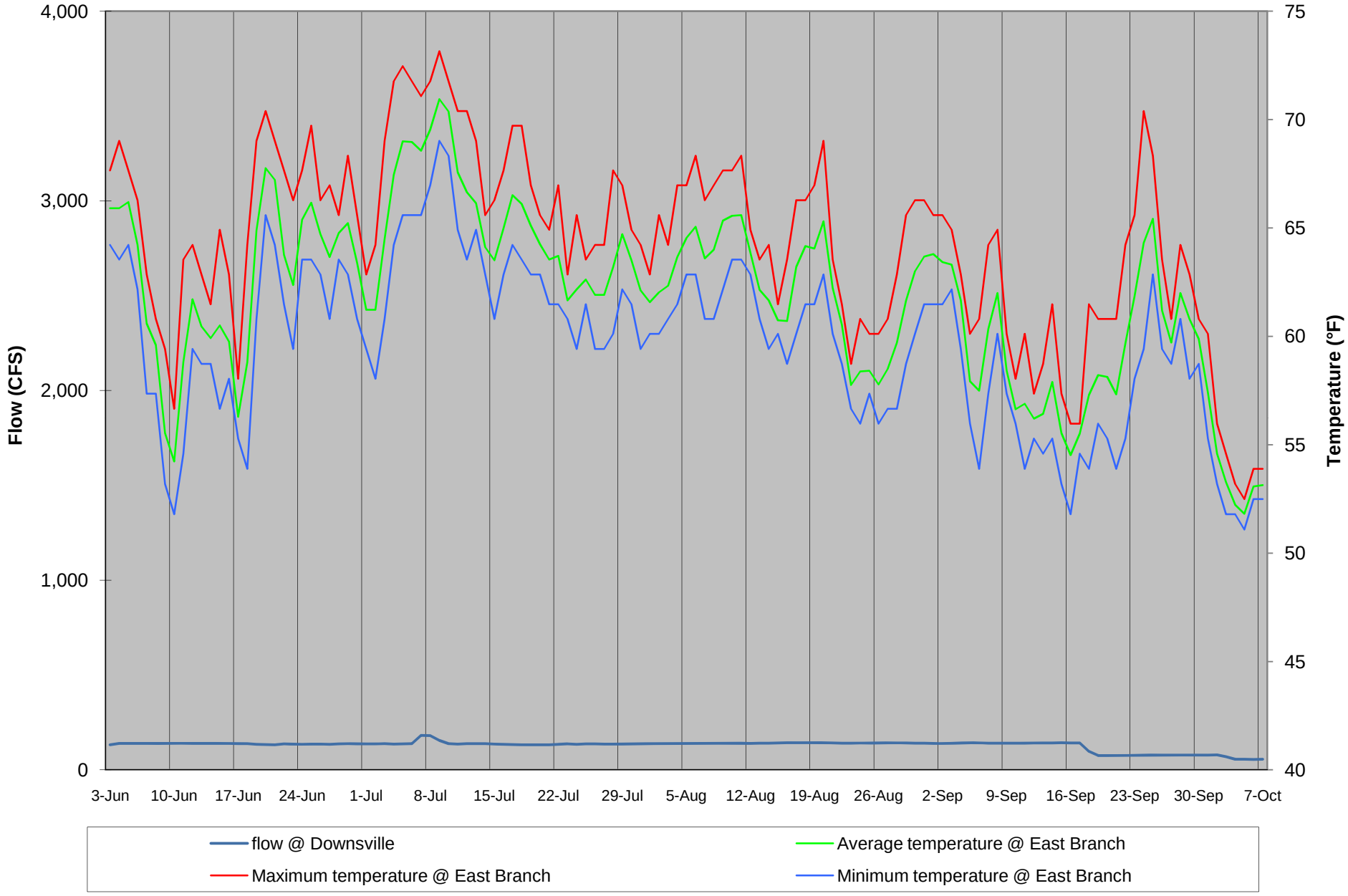
Appendix 3M. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Deutch's Flat, along with daily average flows at Downsville, 2010.



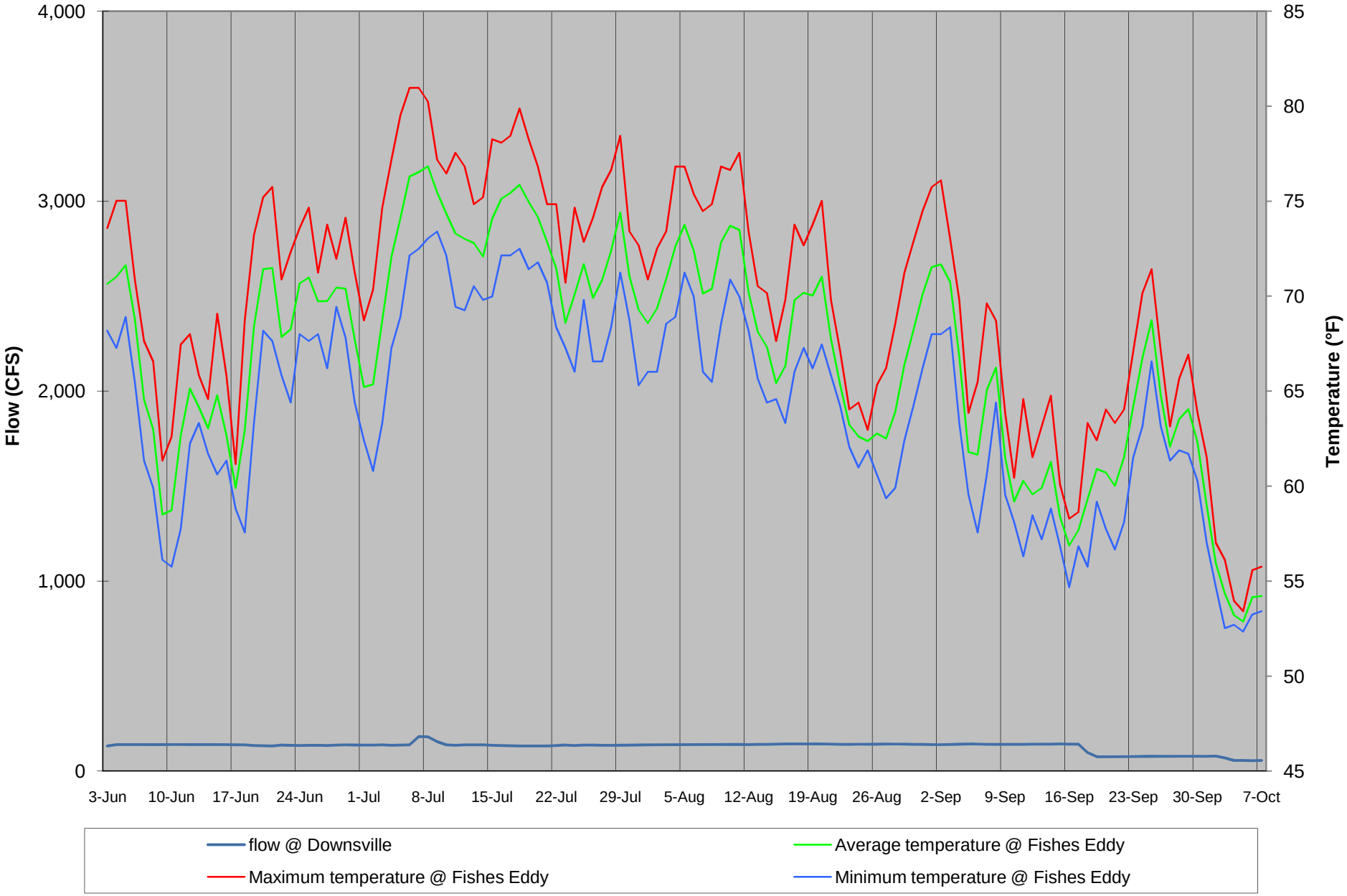
Appendix 3N. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the East Branch at Harvard, along with daily average flows at Downsville, 2010.



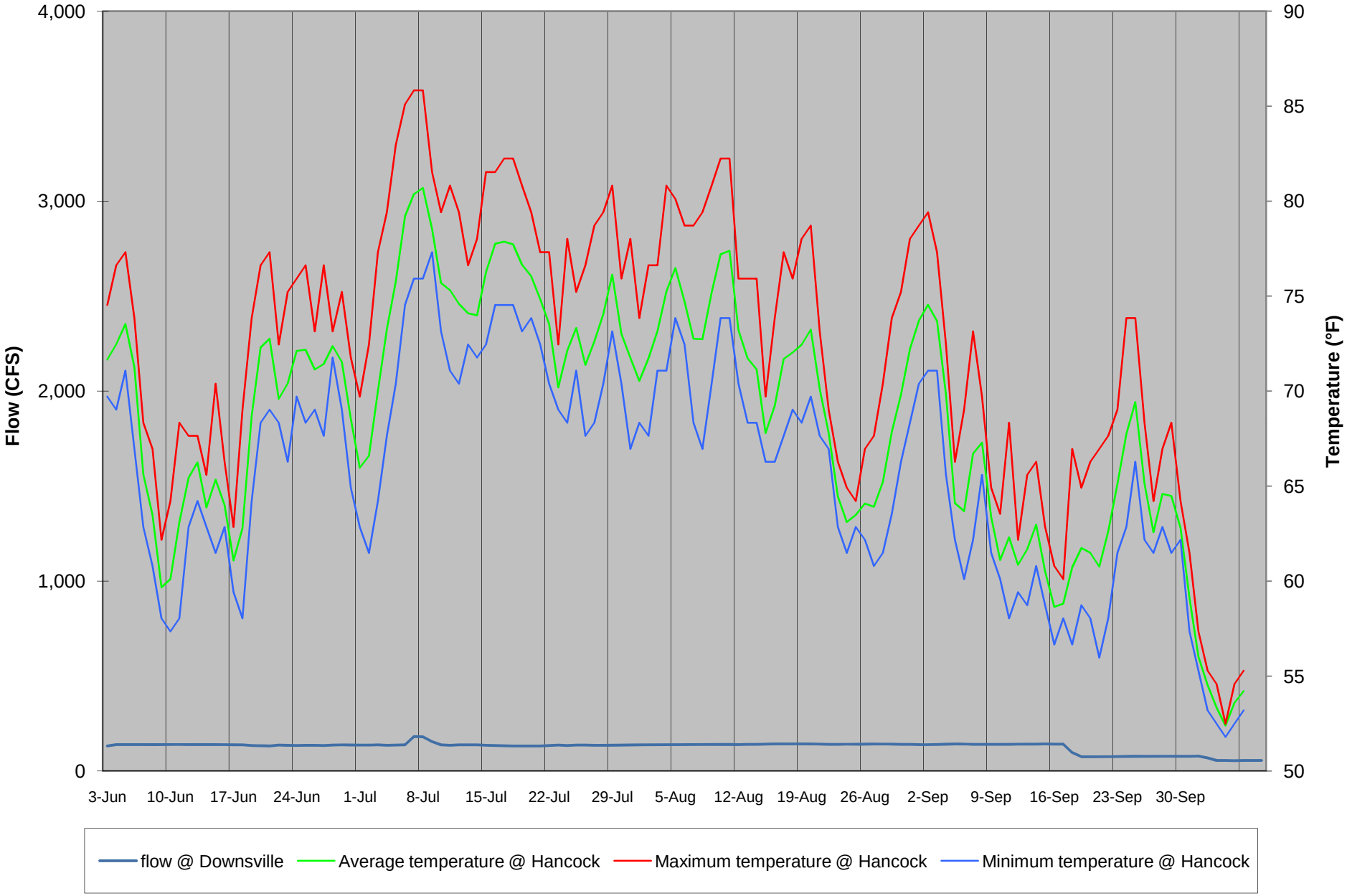
Appendix 3O. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at East Branch, along with daily average flows at Downsville, 2010.



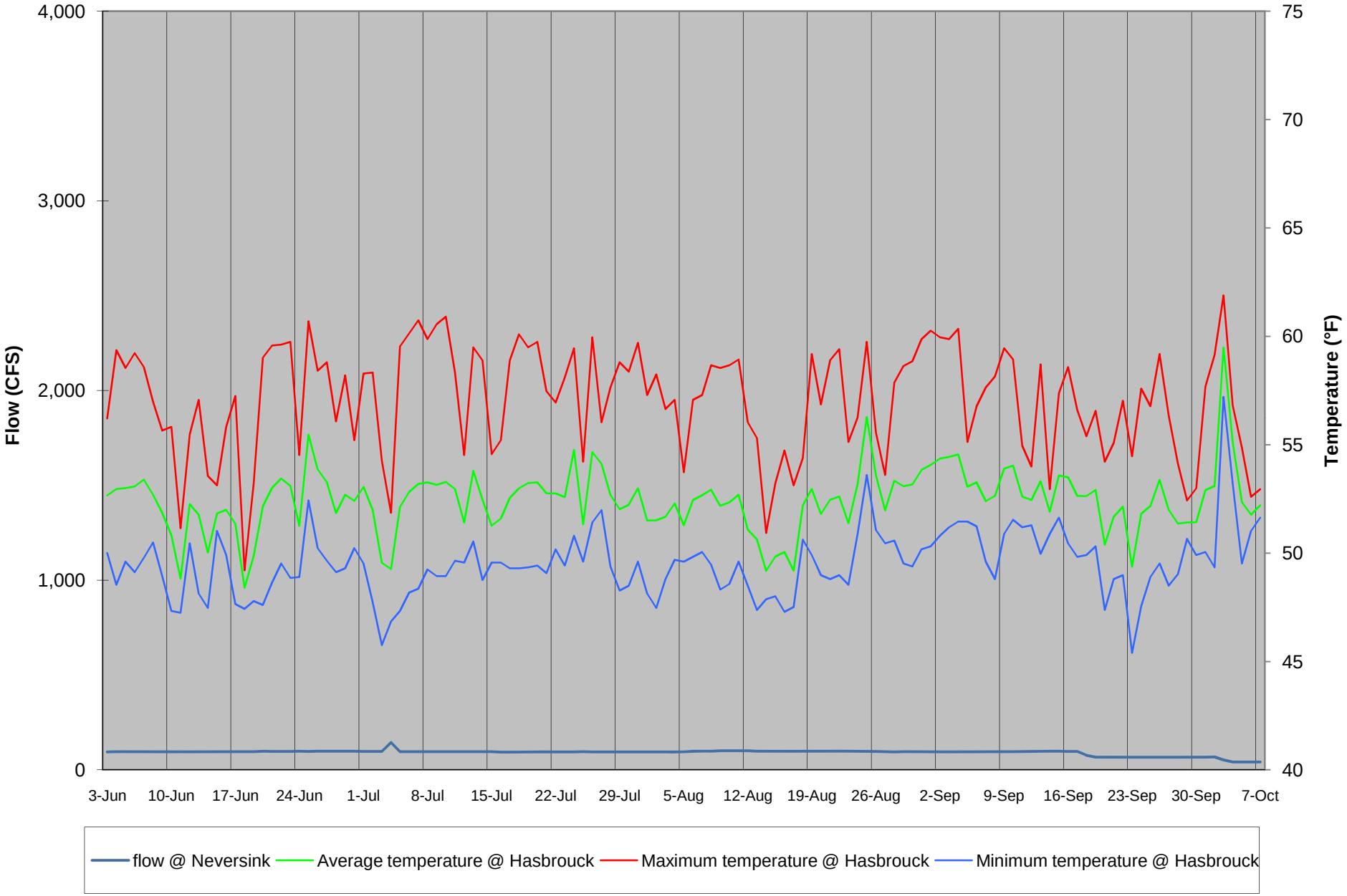
Appendix 3P. Summer daily average, maximum, and minimum water temperature profiles from the USGS gage on the East Branch at Fishs Eddy, along with daily average flows at Downsville, 2010.



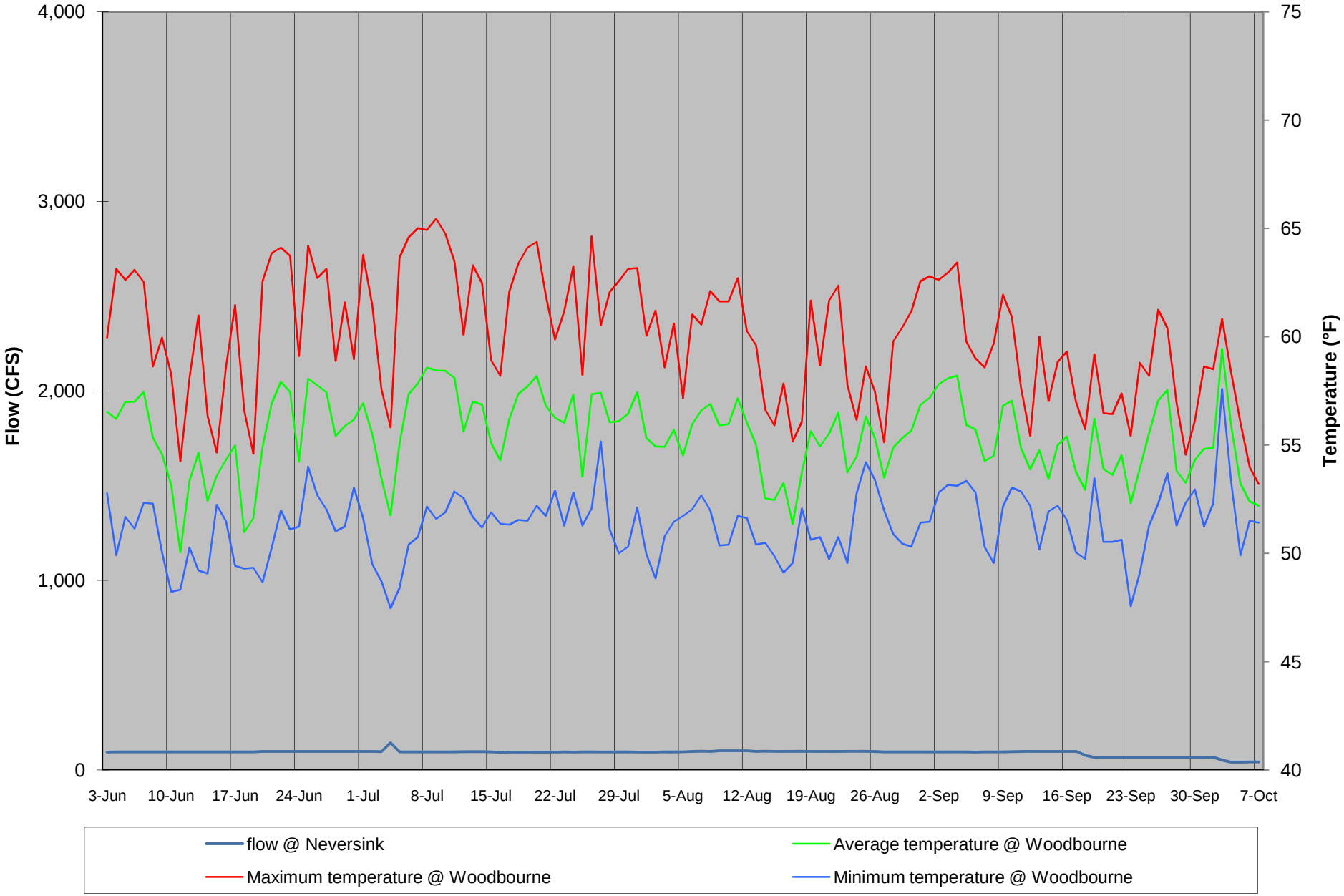
Appendix 3Q. Summer daily average, maximum, and minimum water temperature profiles on the East Branch at Hancock, along with daily average flows at Downsville, 2010.



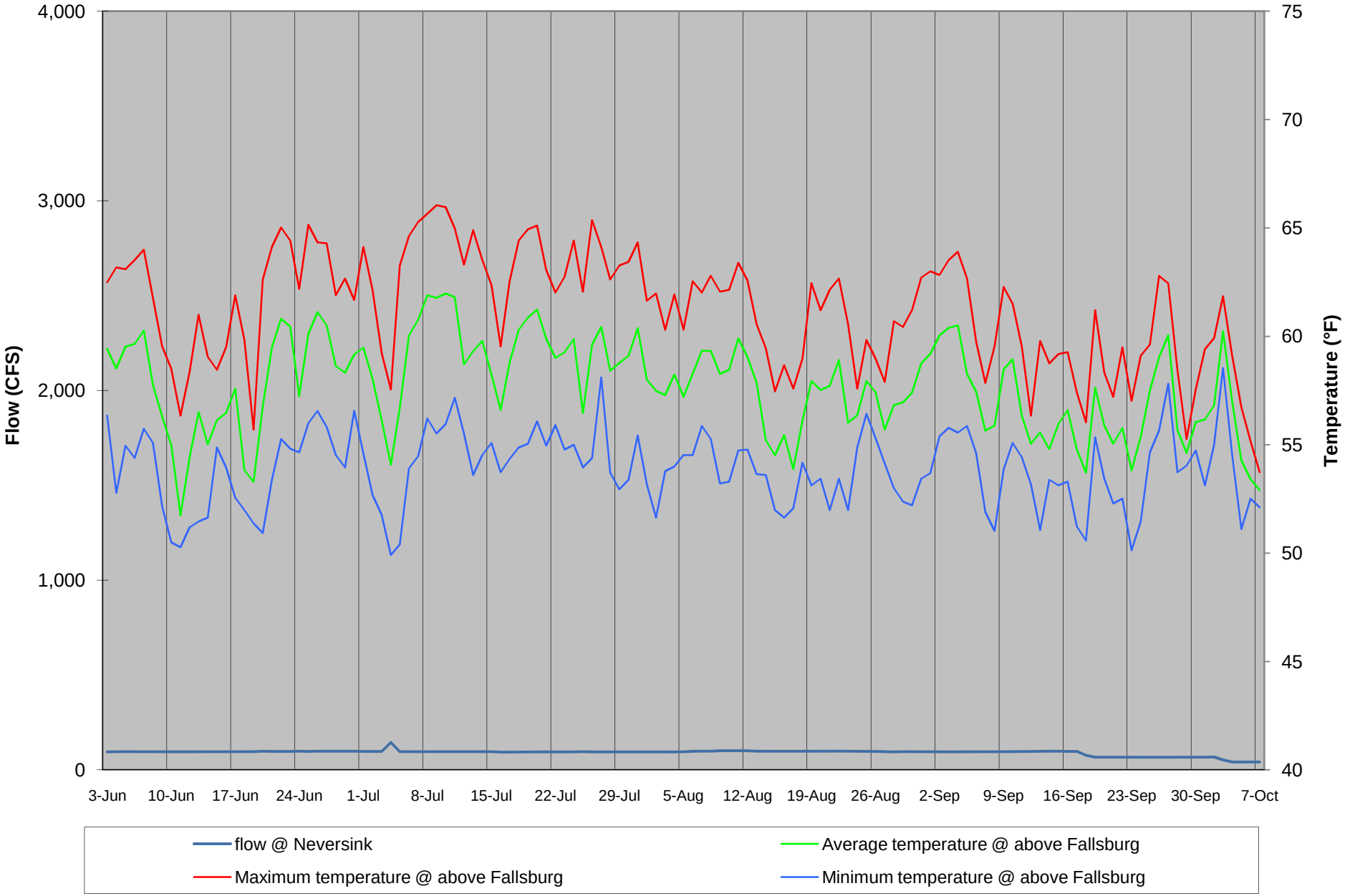
Appendix 3R. Summer daily average, maximum, and minimum water temperature profiles on the Neversink at Hasbrouck, along with daily average flows at Neversink, 2010.



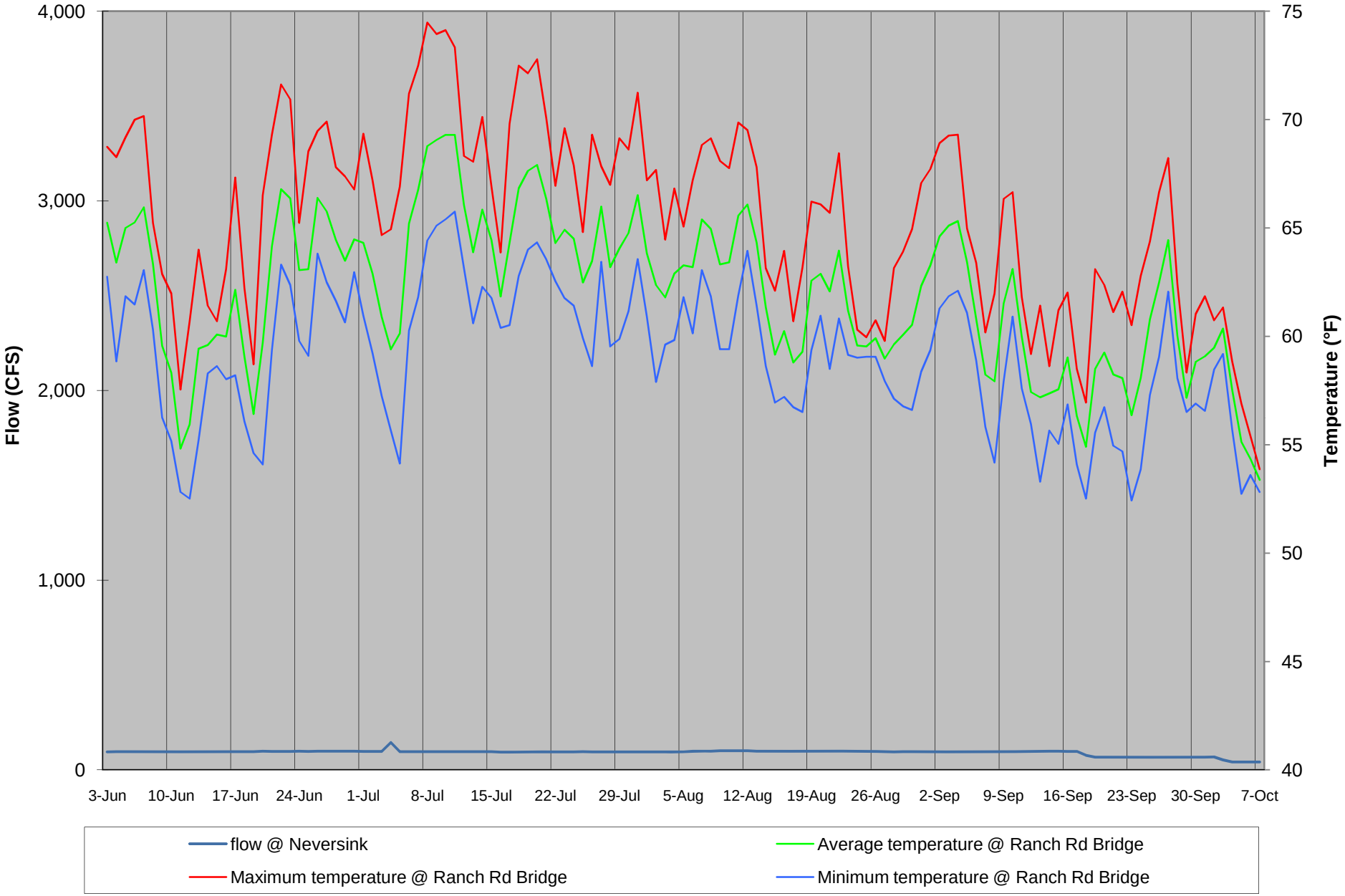
Appendix 3S. Summer daily average, maximum, and minimum water temperature profiles on the Neversink at Woodbourne, along with daily average flows at Neversink, 2010.



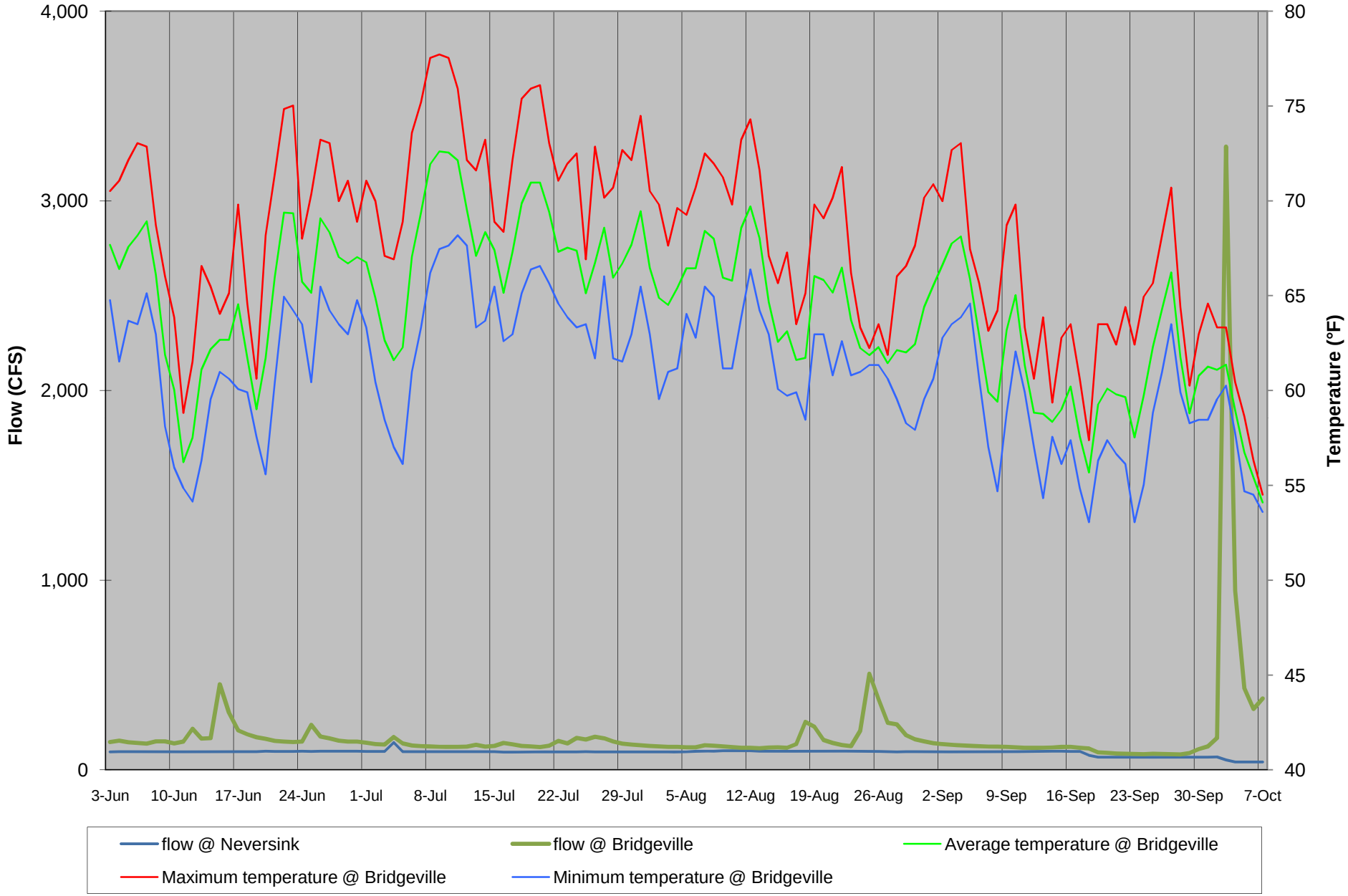
Appendix 3T. Summer daily average, maximum, and minimum water temperature profiles on the Neversink just above Fallsburg, along with daily average flows at Neversink, 2010.



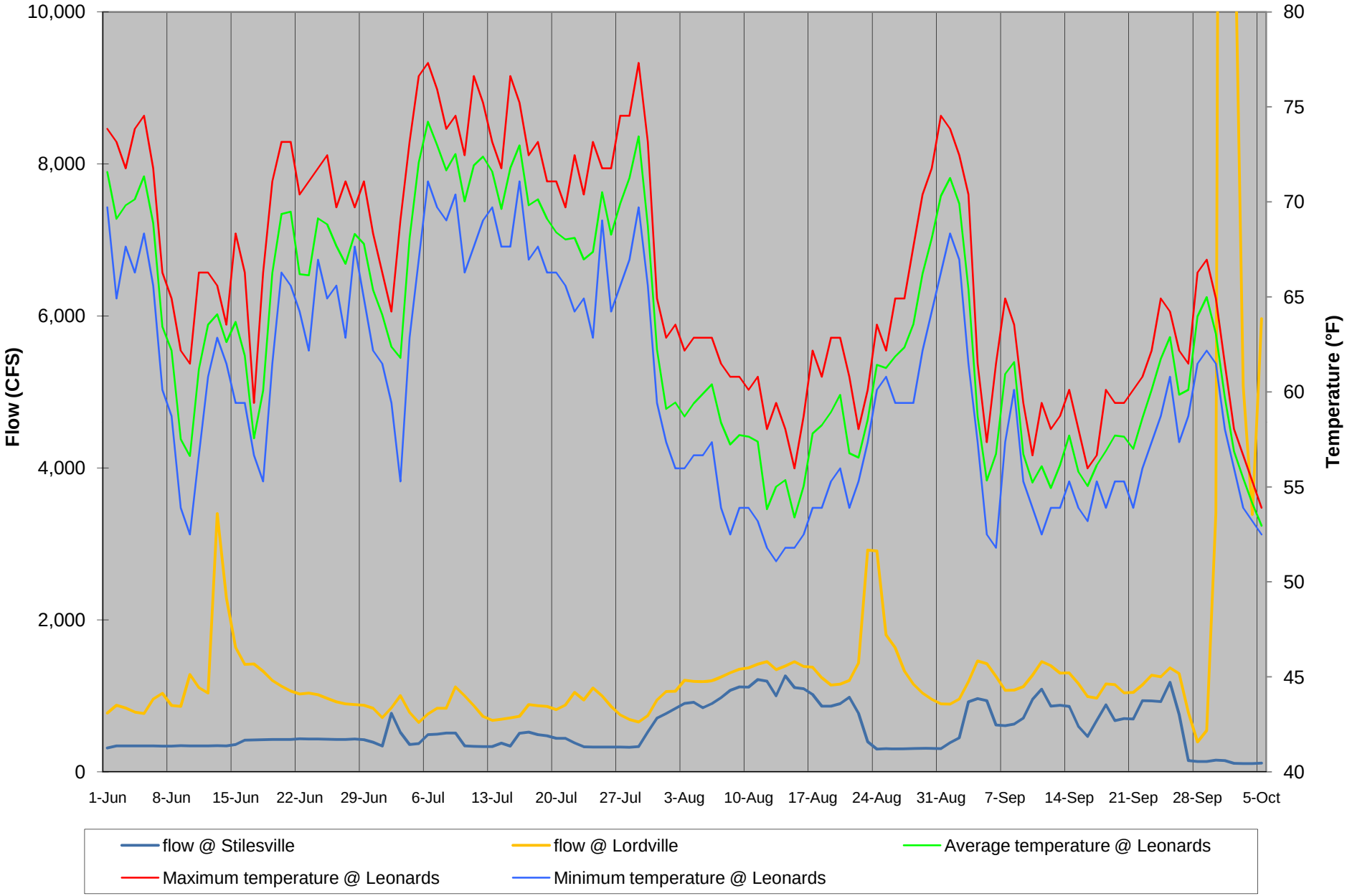
Appendix 3U. Summer daily average, maximum, and minimum water temperature profiles on the Neversink at Ranch Rd bridge, along with daily average flows at Neversink, 2010.



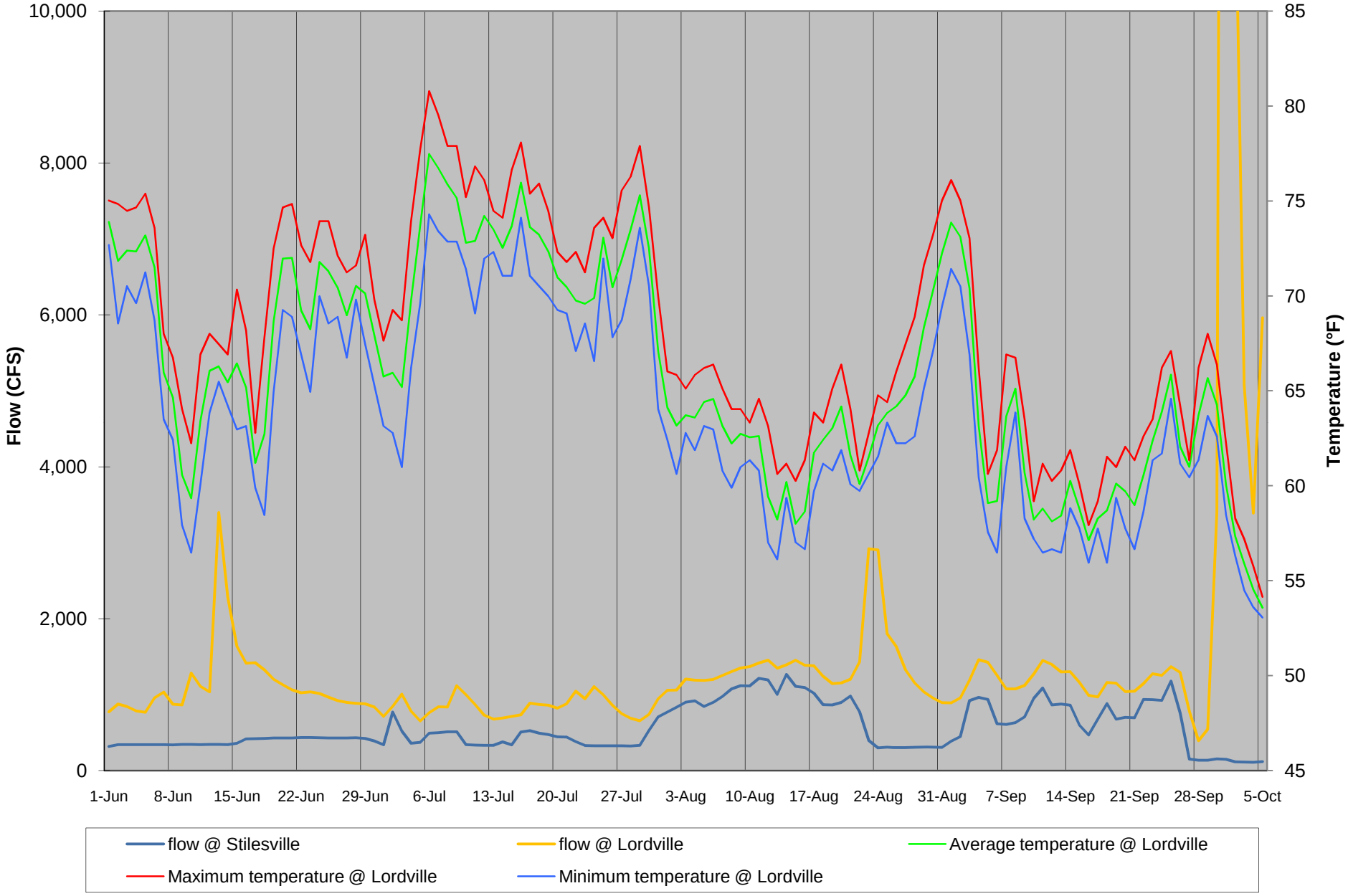
Appendix 3V. Summer daily average, maximum, and minimum water temperature profiles on the Neversink at Bridgeville, along with daily average flows at Bridgeville & Neversink, 2010.



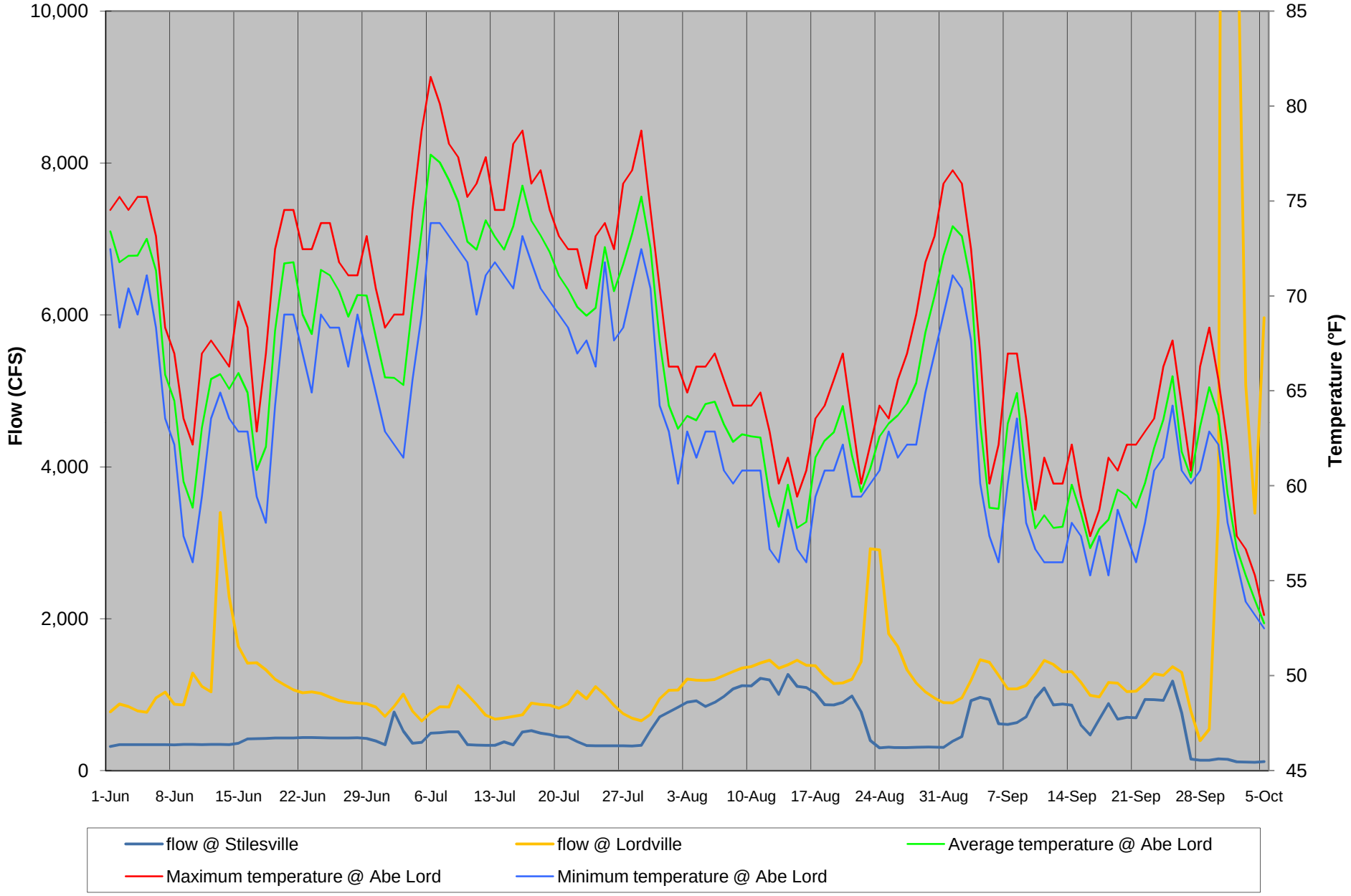
Appendix 3W. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Leonards, along with daily average flows at Stilesville on the West Branch and Lordville, 2010.



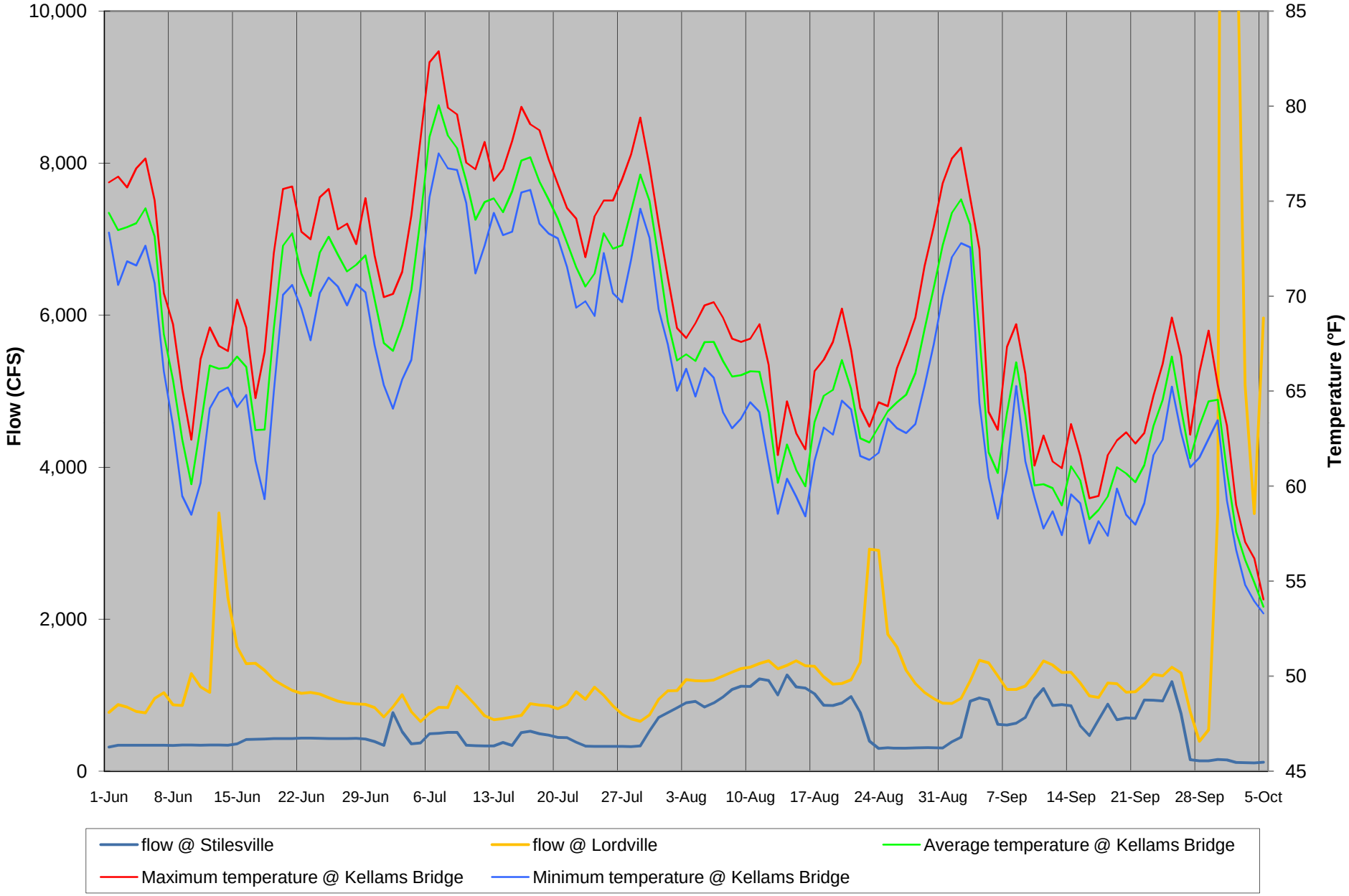
Appendix 3X. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Lordville, along with daily average flows at Stilesville on the West Branch and Lordville, 2010.



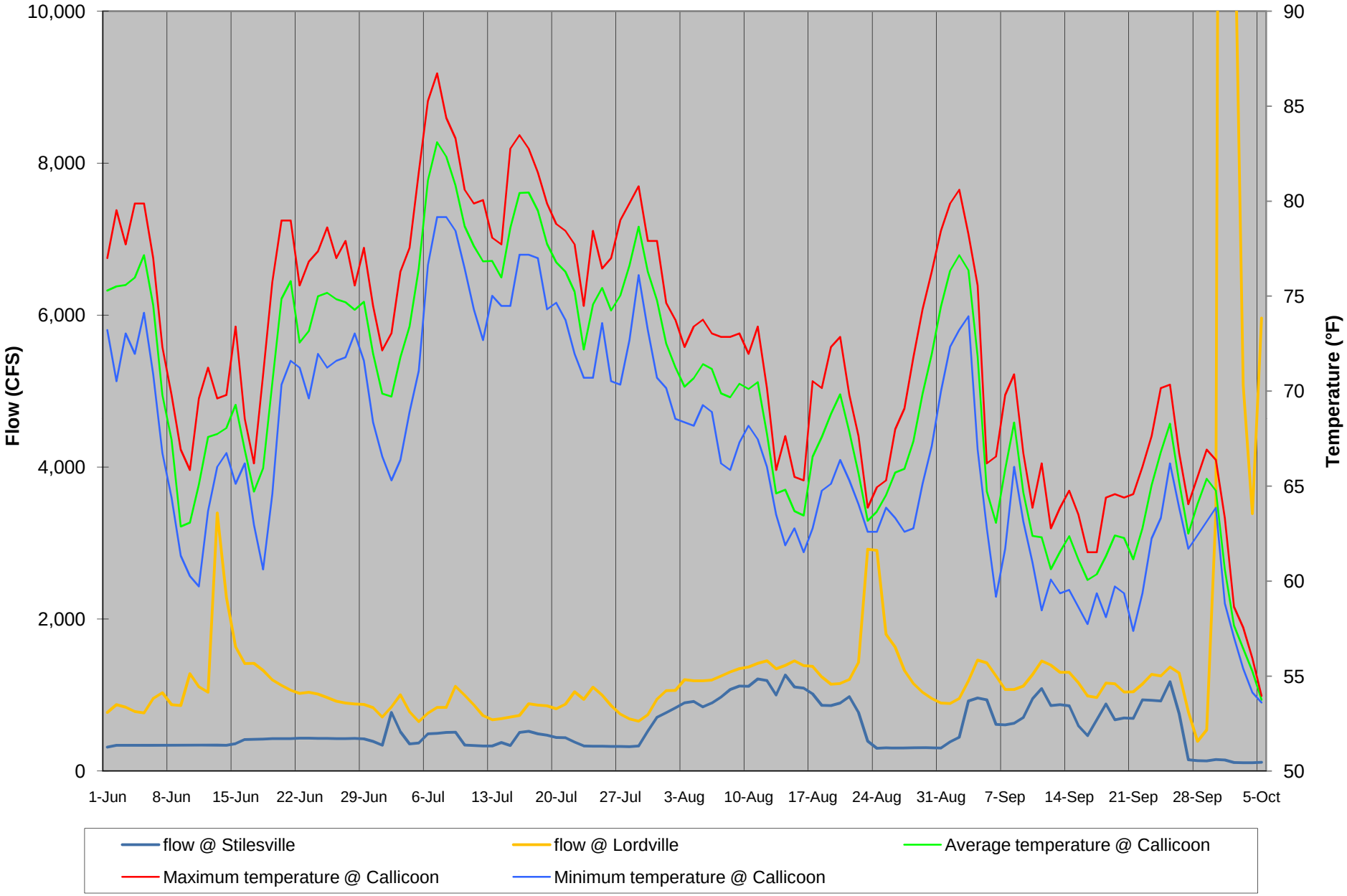
Appendix 3Y. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Abe Lord, along with daily average flows at Stilesville on the West Branch and Lordville, 2010.



Appendix 3Z. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Kellams Bridge, along with daily average flows at Stilesville on the West Branch and Lordville, 2010.



Appendix 3AA. Summer daily average, maximum, and minimum water temperature profiles on the Delaware River at Callicoon, along with daily average flows at Stilesville on the West Branch and Lordville, 2010.



Appendix 4:

UPPER DELAWARE TAILWATERS

2008 Trout Population Studies

East Branch: Appendices 4A to 4D
Neversink River: Appendices 4E to 4G

Appendix 4A: Summary of the 2008 trout population study at Airport Pool on the East Branch.

Airport Pool-2008 June 24-25
4.2 miles below dam 186-179 cfs

Inch Group	Number	Mean Wt(lbs)	Percent	BT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
3	2	0.0214	0.0241	2	4	0.08	1.4	0.0
4	28	0.0344	0.3373	28	51	1.75	19.8	0.7
5	28	0.0555	0.3373	28	51	2.83	19.8	1.1
6	13	0.0941	0.1566	13	24	2.23	9.2	0.9
7	7	0.1423	0.0843	7	13	1.81	5.0	0.7
8	2	0.2363	0.0241	2	4	0.86	1.4	0.3
9	1	0.2892	0.0120	1	2	0.53	0.7	0.2
10								
11								
12								
13								
14	1	1.1454	0.0120	1	2	2.08	0.7	0.8
15								
16								
17	1	2.1145	0.0120	1	2	3.85	0.7	1.5
Totals	**83**		**1**	**83**	**151**	**16.01**	**58.8**	**6.2**

Marked	Captured	Recaps
62	35	14

Station length=1077 ft
Width=104 ft
Acreage=2.57 acres

Population = 151 **CI = 101-201**

CI = ±50

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	71	5.18	0.053	0.8554	129	6.88	50.3	2.7
Age 2	10	7.80	0.176	0.1205	18	3.20	7.1	1.2
Age 3	1	14.13	1.145	0.0120	2	2.08	0.7	0.8
Age 4	1	17.52	2.115	0.0120	2	3.85	0.7	1.5
Totals	**83**			**1**	**151**	**16.01**	**58.8**	**6.2**

Appendix 4B: Summary of the 2008 trout population study at the T28 Pool on the East Branch.

T28 Pool-2008 June 26-27
6.3 miles below dam 179-176 cfs

Inch Group	Number	Mean Wt(lbs)	Percent	BT	HBT	RT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
3	3	0.0207	0.0167	3			6	0.12	3.9	0.1
4	81	0.0347	0.4500	81			150	5.20	105.5	3.7
5	66	0.0581	0.3667	66			122	7.10	86.0	5.0
6	11	0.0930	0.0611	11			20	1.89	14.3	1.3
7	3	0.1611	0.0167	3			6	0.89	3.9	0.6
8	10	0.2080	0.0556	9		1	19	3.85	13.0	2.7
9	4	0.3196	0.0222	2	2		7	2.37	5.2	1.7
10										
11										
12										
13	1	0.9031	0.0056	1			2	1.67	1.3	1.2
14										
15										
16										
17										
18										
19										
20	1	2.5110	0.0056	1			2	4.65	1.3	3.3
Totals	**180**		**1.0**	**177**	**2**	**1**	**333**	**27.73**	**234.5**	**19.5**

Marked	Captured	Recaps
110	100	33

Station length=653 ft
Width=95 ft
Acreage=1.42 acres

Population = 333* **CI = 257-409**

CI = ±76

*3 fish died on marking run. Added to the population estimate

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	163	5.06	0.049	0.9056	302	14.86	212.4	10.5
Age 2	12	8.51	0.225	0.0667	22	4.99	15.6	3.5
Age 3	1	13.62	0.903	0.0056	2	1.67	1.3	1.2
Age 5	1	20.24	2.511	0.0056	2	4.65	1.3	3.3

Hatchery Brown Trout

Age 1	2	9.67	0.324	0.0111	4	1.20	2.6	0.8

Rainbow Trout

Age 2	1	8.19	0.198	0.0056	2	0.37	1.3	0.3
Totals	**180**			**1**	**333**	**27.73**	**234.5**	**19.5**

Appendix 4C: Summary of the 2008 trout population study at the Cabin Pool on the East Branch.

Cabin Pool-2008 July 7-8
9.9 miles below dam 170-170 cfs

Inch Group	Number	Mean Wt(lbs)	Percent	BT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
4	7	0.0409	0.0493	7	18	0.73	3.9	0.2
5	62	0.0613	0.4366	62	158	9.66	34.3	2.1
6	56	0.0972	0.3944	56	142	13.84	30.9	3.0
7	9	0.1433	0.0634	9	23	3.28	5.0	0.7
8	1	0.2096	0.0070	1	3	0.53	0.6	0.1
9	1	0.3356	0.0070	1	3	0.85	0.6	0.2
10								
11								
12								
13								
14								
15	1	1.5198	0.0070	1	3	3.86	0.6	0.8
16			0.0000		0	0.00	0.0	0.0
17	2	2.0264	0.0141	2	5	10.30	1.1	2.2
18								
19								
20	1	3.3260	0.0070	1	3	8.46	0.6	1.8
21								
22	2	3.9978	0.0141	2	5	20.33	1.1	4.4
Totals	**142**		**1**	**142**	**361**	**71.84**	**78.5**	**15.6**

Marked	Captured	Recaps
96	58	15

Station length=1806 ft
Width=111 ft
Acreage=4.60 acres

Population = 361 **CI = 226-496**

CI = ±135

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	134	6.00	0.081	0.9437	341	27.51	74.1	6.0
Age 2	2	9.06	0.273	0.0141	5	1.39	1.1	0.3
Age 3	2	16.42	1.652	0.0141	5	8.40	1.1	1.8
Age 4	1	17.76	2.269	0.0070	3	5.77	0.6	1.3
Age 5	1	20.43	3.326	0.0070	3	8.46	0.6	1.8
Age 6	2	22.66	3.998	0.0141	5	20.33	1.1	4.4
Totals	**142**			**1.0000**	**361**	**71.84**	**78.5**	**15.6**

Appendix 4D: Summary of the 2008 trout population study at the T22 Pool on the East Branch.

T22 Pool-2008 July 9-10
14.9 miles below dam 170-170 cfs

Inch Group	Number	Mean Wt(lbs)	Percent	BT	RT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
5	1	0.0757	0.0833	1		2	0.13	0.9	0.1
6	3	0.101	0.2500	3		5	0.53	2.8	0.3
7	2	0.138	0.1667	2		4	0.48	1.9	0.3
8									
9	2	0.299	0.1667	2		4	1.05	1.9	0.6
10									
11									
12	1	0.7930	0.0833	1		2	1.39	0.9	0.7
13	1	0.8150	0.0833	1		2	1.43	0.9	0.8
14									
15	1	1.4868	0.0833		1	2	2.60	0.9	1.4
16									
17									
18									
19									
20									
21	1	3.2599	0.0833	1		2	5.70	0.9	3.0
Totals	**12**		**1**	**11**	**1**	**21**	**13.31**	**11.1**	**7.0**

Marked	Captured	Recaps
7	7	2

Station length=948 ft
Width=87 ft
Acreage=1.89 acres

Population = 21 **CI = 7-35**

CI = ±14

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	6	6.68	0.109	0.5000	11	1.15	5.6	0.6
Age 2	2	9.39	0.299	0.1667	4	1.05	1.9	0.6
Age 3	2	13.11	0.804	0.1667	4	2.81	1.9	1.5
Age 6	1	21.14	3.260	0.0833	2	5.70	0.9	3.0

Rainbow Trout

Age 3	1	15.16	1.487	0.0833	2	2.60	0.9	1.4
Totals	**12**			**1**	**21**	**13.31**	**11.1**	**7.0**

Appendix 4E: Summary of the 2008 trout population study at Hasbrouck on the Neversink River.

Hasbrouck-2008 July 28-29
2.8 miles below dam 99-99 cfs

Inch Group	Number	Mean Wt (lbs)	Percent	BT	HBT	ST	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
5	3	0.0696	0.1364	2		1	5	0.36	6.2	0.4
6	7	0.0915	0.3182	6		1	12	1.11	14.4	1.3
7										
8	4	0.1992	0.1818	3	1		7	1.38	8.2	1.6
9	1	0.3157	0.0455	1			2	0.55	2.1	0.6
10	1	0.4330	0.0455	1			2	0.75	2.1	0.9
11										
12										
13										
14										
15	2	1.3656	0.0909	2			3	4.72	4.1	5.6
16	2	1.5969	0.0909	2			3	5.52	4.1	6.6
17	1	1.8722	0.0455	1			2	3.23	2.1	3.8
18										
19										
20										
21	1	2.7753	0.0455	1			2	4.79	2.1	5.7
TOTALS	**22**		**1**	**19**	**1**	**2**	**38**	**22.40**	**45.2**	**26.7**

Marked	Captured	Recaps
18	7	3

Length=330 ft
Width=111 ft
Area=0.84 acres

Population = 38 **CI = 17-59**

CI = ± 21

Wild Brown Trout

	Number	Length (in)	Weight (lbs)	Percent	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
Age 1	10	6.4	0.098	0.4545	17	1.70	20.6	2.0
Age 2	4	9.1	0.282	0.1818	7	1.95	8.2	2.3
Age 4	5	17.4	1.859	0.2273	9	16.06	10.3	19.1
Age ?	1	15.4	1.278	0.0455	2	2.21	2.1	2.6

Hatchery Brown Trout

Age 1	1	8.0	0.187	0.0455	2	0.32	2.1	0.4

Brook Trout

Age 1	1	5.91	0.074	0.0455	2	0.13	2.1	0.2
Totals	**22**			**1**	**38**	**22.36**	**45.2**	**26.6**

Appendix 4F: Summary of the 2008 trout population study at Fallsburg on the Neversink River.

Fallsburg - 2008 July 28-29
8.0 miles below dam 267-179 cfs at Bridgeville

Inch Group	Number	Mean Wt (Lbs)	Percent	BT	HBT	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
4									
5	1	0.0643	0.0357	1		3	0.18	2.0	0.1
6	12	0.0974	0.4286	12		34	3.34	23.5	2.3
7	5	0.1404	0.1786	5		14	2.01	9.8	1.4
8	2	0.1953	0.0714	2		6	1.12	3.9	0.8
9									
10									
11	2	0.5370	0.0714	2		6	3.07	3.9	2.1
12	2	0.6608	0.0714	2		6	3.78	3.9	2.6
13									
14									
15									
16	2	1.7621	0.0714	2		6	10.07	3.9	6.9
17	2	1.9273	0.0714	1	1	6	11.01	3.9	7.5
TOTALS	**28**		**1**	**27**	**1**	**80**	**34.57**	**54.8**	**23.7**

Marked	Captured	Recaps
19	11	2

Length=714 ft
Width=89 ft
Area=1.46 acres

Population = 80 **CI = 17-143**

CI = ± 63

Wild Brown Trout

	Number	Length (in)	Weight (lbs)	Percent	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
Age 1	20	6.8	0.116	0.7143	57	6.65	39.1	4.6
Age 2	4	12.0	0.599	0.1429	11	6.84	7.8	4.7
Age 3	1	16.5	1.806	0.0357	3	5.16	2.0	3.5
Age ?	2	16.9	1.795	0.0714	6	10.26	3.9	7.0

Hatchery Brown Trout

Age 3	1	17.6	1.982	0.0357	3	5.66	2.0	3.9
Totals	**28**			**1**	**80**	**34.57**	**54.8**	**23.7**

Appendix 4G: Summary of the 2008 trout population study at Ranch Road on the Neversink River.

Ranch Road - 2008 July 28-29
12.9 miles below dam 267-179 cfs

Inch Group	Number	Mean Wt (lbs)	Percent	BT	HBT	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
5	1	0.0685	0.0204	1		2	0.12	3.4	0.2
6									
7	6	0.1531	0.1224	6		10	1.56	20.2	3.1
8	11	0.2197	0.2245	11		19	4.09	37.1	8.2
9	7	0.2960	0.1429	6	1	12	3.51	23.6	7.0
10	7	0.4007	0.1429	1	6	12	4.75	23.6	9.5
11	3	0.5570	0.0612	1	2	5	2.83	10.1	5.6
12	1	0.7048	0.0204	1		2	1.19	3.4	2.4
13	6	0.8921	0.1224	6		10	9.07	20.2	18.1
14	1	1.1894	0.0204	1		2	2.01	3.4	4.0
15	2	1.3216	0.0408	1	1	3	4.48	6.7	8.9
16	1	1.7621	0.0204	1		2	2.98	3.4	5.9
17									
18	1	2.2026	0.0204	1		2	3.73	3.4	7.4
19	2	2.8634	0.0408	1	1	3	9.70	6.7	19.3
TOTALS	**49**		**1**	**38**	**11**	**83**	**50.02**	**165.3**	**99.7**

Marked	Captured	Recaps
33	26	10

Length=486 ft
Width=45 ft
Area=0.50 acres

Population = 83 **CI = 53-113**

CI = ± 30

Wild Brown Trout

	Number	Length (in)	Weight (lbs)	Percent	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
Age 1	23	8.3	0.216	0.4694	39	8.41	77.6	16.8
Age 2	8	13.5	0.906	0.1633	14	12.28	27.0	24.5
Age 4	1	19.3	2.423	0.0204	2	4.10	3.4	8.2
Age 5	1	18.9	2.203	0.0204	2	3.73	3.4	7.4
Age ?	5	12.4	0.836	0.1020	8	7.08	16.9	14.1

Hatchery Brown Trout

Age 1	5	10.3	0.402	0.1020	8	3.40	16.9	6.8
Age ?	6	12.9	1.084	0.1224	10	11.02	20.2	21.9
Totals	**49**			**1**	**83**	**50.02**	**165.3**	**99.7**

Appendix 5:

UPPER DELAWARE TAILWATERS

2009 Trout Population Studies

West Branch: Appendices 5A to 5D
East Branch: Appendices 5E to 5H
Neversink River: Appendices 5I to 5K

Appendix 5A: Summary of the 2009 trout population study at Stilesville on the West Branch.

Stilesville-2009 July 15-16

2.1 miles below dam 372-377 cfs

Inch Group	Number	Mean Wt(lbs)	Percentage	BT	HBT	RT	ST	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
4	30	0.0365	0.0855	30				89	3.26	10.3	0.4
5	103	0.0610	0.2934	102		1		306	18.69	35.4	2.2
6	75	0.0964	0.2137	74		1		223	21.50	25.8	2.5
7	27	0.1385	0.0769	27				80	11.12	9.3	1.3
8	7	0.2406	0.0199	7				21	5.01	2.4	0.6
9	8	0.3169	0.0228	6	2			24	7.54	2.8	0.9
10	5	0.4015	0.0142	5				15	5.97	1.7	0.7
11	1	0.6167	0.0028	1				3	1.83	0.3	0.2
12	1	0.6608	0.0028				1	3	1.97	0.3	0.2
13	7	1.0179	0.0199	6	1			21	21.19	2.4	2.5
14	7	1.2508	0.0199	5		2		21	26.04	2.4	3.0
15	19	1.4943	0.0541	18		1		57	84.45	6.5	9.8
16	26	1.7630	0.0741	22		4		77	136.34	8.9	15.8
17	21	2.0159	0.0598	18		3		62	125.92	7.2	14.6
18	8	2.4367	0.0228	5		3		24	57.98	2.8	6.7
19	1	2.7533	0.0028	1				3	8.19	0.3	0.9
20	3	3.2599	0.0085	3				9	29.09	1.0	3.4
21	1	2.9295	0.0028	1				3	8.71	0.3	1.0
22			0.0000					0	0.00	0.0	0.0
23	1	5.0661	0.0028	1				3	15.07	0.3	1.7
Totals	**351**		**1**	**332**	**3**	**15**	**1**	**1044**	**589.87**	**120.7**	**68.2**

Marked	Captured	Recaps
227	144	31

Length=1884 ft
Width=200 ft
Area=8.65 acres

Population = 1044 **CI = 750-1,338**

CI = ± 294

Note: 11 yearling trout died during the marking effort. These 11 fish were added to the estimated N.

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	231	5.88	0.077	0.6581	687	53.10	79.4	6.1
Age 2	21	9.53	0.331	0.0598	62	20.68	7.2	2.4
Age 3	22	14.94	1.380	0.0627	65	90.27	7.6	10.4
Age 4	48	16.64	1.838	0.1368	143	262.45	16.5	30.3
Age 5	8	18.77	2.627	0.0228	24	62.50	2.8	7.2
Age 6	1	21.06	2.930	0.0028	3	8.71	0.3	1.0
Age 7	1	23.82	5.066	0.0028	3	15.07	0.3	1.7

Hatchery Brown Trout

Age 1	2	9.65	0.324	0.0057	6	1.93	0.7	0.2
Age 4	1	13.82	1.035	0.0028	3	3.08	0.3	0.4

Wild Rainbow Trout

Age 1	2	6.10	0.085	0.0057	6	0.50	0.7	0.1
Age 3	2	15.35	1.344	0.0057	6	7.99	0.7	0.9
Age 4	9	16.80	1.795	0.0256	27	48.05	3.1	5.6
Age 5	2	18.70	2.280	0.0057	6	13.56	0.7	1.6

Wild Brook Trout

Age 2	1	12.01	0.661	0.0028	3	1.97	0.3	0.2
Totals	**351**			**1**	**1044**	**589.87**	**120.7**	**68.2**

Appendix 5B: Summary of the trout population study at the No Kill on the West Branch.

No Kill-2009 July 22-23

3.9 miles below dam 383 cfs both days

Inch Group	Number	Mean Wt(lbs)	Percentage	BT	HBT	RT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
4	3	0.0400	0.0144	3			14	0.56	0.7	0.0
5	36	0.0655	0.1731	36			168	10.97	8.7	0.6
6	83	0.0993	0.3990	83			386	38.36	20.1	2.0
7	34	0.1412	0.1635	34			158	22.35	8.2	1.2
8	2	0.2133	0.0096	2			9	1.99	0.5	0.1
9										
10	2	0.4528	0.0096	1	1		9	4.21	0.5	0.2
11										
12										
13	1	0.9692	0.0048	1			5	4.51	0.2	0.2
14										
15	8	1.4510	0.0385	8			37	54.02	1.9	2.8
16	10	1.7203	0.0481	10			47	80.06	2.4	4.2
17	13	1.9061	0.0625	12		1	61	115.32	3.2	6.0
18	4	2.5110	0.0192	4			19	46.74	1.0	2.4
19	5	2.6564	0.0240	5			23	61.81	1.2	3.2
20	1	2.6211	0.0048	1			5	12.20	0.2	0.6
21	4	3.6013	0.0192	4			19	67.04	1.0	3.5
22										
23	1	4.1410	0.0048	1			5	19.27	0.2	1.0
24	1	5.5507	0.0048	1			5	25.83	0.2	1.3
Totals	**208**		**1**	**206**	**1**	**12**	**968**	**565.25**	**50.4**	**29.4**

Marked	Captured	Recaps
134	85	11

Length=3428 ft
Width=244 ft
Area=19.20 acres

Population = 968 **CI = 493-1443**

CI = ± 475

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	157	6.46	0.100	0.7548	731	73.13	38.1	3.8
Age 2	2	9.80	0.353	0.0096	9	3.29	0.5	0.2
Age 3	14	16.27	1.617	0.0673	65	105.38	3.4	5.5
Age 4	26	17.64	2.105	0.1250	121	254.73	6.3	13.3
Age 5	5	19.93	3.079	0.0240	23	71.65	1.2	3.7
Age 6	1	23.62	4.141	0.0048	5	19.27	0.2	1.0
Age 7	1	24.84	5.551	0.0048	5	25.83	0.2	1.3

Hatchery Brown Trout

Age 1	1	10.63	0.433	0.0048	5	2.02	0.2	0.1

Wild Rainbow Trout

Age 4	1	17.48	2.137	0.0048	5	9.94	0.2	0.5
Totals	**208**			**1**	**968**	**565.25**	**50.4**	**29.4**

Appendix 5C: Summary of the 2009 trout population study at Hale Eddy on the West Branch.

Hale Eddy-2009 July 20-21

7.9 miles below dam 497 cfs on both days

Inch Group	Number	Mean Wt(lbs)	Percentage	BT	RT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
4	6	0.0375	0.0147	6		44	1.65	2.7	0.1
5	55	0.0666	0.1345	55		404	26.92	25.2	1.7
6	146	0.0991	0.3570	145	1	1072	106.26	66.9	6.6
7	95	0.1464	0.2323	89	6	698	102.18	43.5	6.4
8	16	0.1985	0.0391	14	2	118	23.33	7.3	1.5
9	4	0.2939	0.0098	3	1	29	8.64	1.8	0.5
10	17	0.4109	0.0416	17		125	51.31	7.8	3.2
11	7	0.5413	0.0171	7		51	27.83	3.2	1.7
12	5	0.7225	0.0122	5		37	26.53	2.3	1.7
13									
14	6	1.0977	0.0147	4	2	44	48.37	2.7	3.0
15	15	1.4347	0.0367	14	1	110	158.06	6.9	9.9
16	8	1.7373	0.0196	8		59	102.08	3.7	6.4
17	10	1.9031	0.0244	10		73	139.78	4.6	8.7
18	9	2.1953	0.0220	7	2	66	145.12	4.1	9.0
19	3	2.7533	0.0073	3		22	60.67	1.4	3.8
20	4	2.8965	0.0098	4		29	85.10	1.8	5.3
21	2	3.2709	0.0049	2		15	48.05	0.9	3.0
22	1	3.7004	0.0024	1		7	27.18	0.5	1.7
Totals	**409**		**1**	**394**	**15**	**3004**	**1189.05**	**187.3**	**74.1**

Marked	Captured	Recaps
202	221	14

Length=4235 ft
Width=165 ft
Area=16.04 acres

Population = 3004 **CI = 1571-4437**

CI = ± 1433

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	308	6.64	0.110	0.7531	2262	248.57	141.0	15.5
Age 2	32	10.67	0.456	0.0782	235	107.11	14.7	6.7
Age 3	25	15.89	1.505	0.0611	184	276.32	11.4	17.2
Age 4	25	17.96	2.105	0.0611	184	386.49	11.4	24.1
Age 5	3	20.93	3.209	0.0073	22	70.70	1.4	4.4
Age 6	1	22.64	3.700	0.0024	7	27.18	0.5	1.7

Wild Rainbow Trout

Age 1	9	7.63	0.163	0.0220	66	10.76	4.1	0.7
Age 2	1	9.88	0.348	0.0024	7	2.56	0.5	0.2
Age 3	3	14.66	1.094	0.0073	22	24.10	1.4	1.5
Age 4	2	18.64	2.401	0.0049	15	35.27	0.9	2.2
Totals	**409**			**1**	**3004**	**1189.05**	**187.3**	**74.1**

Appendix 5D: Summary of the trout population at Balls Eddy on the West Branch.

Balls Eddy - 2009 Aug 26-27

12.7 miles below dam 643-601 cfs

Inch Group	Number	Mean Wt(lbs)	Percentage	BT	HBT	RT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
5	1	0.0713	0.0278			1	5	0.38	0.5	0.0
6										
7	1	0.1326	0.0278			1	5	0.70	0.5	0.1
8	6	0.2282	0.1667	2		4	32	7.23	3.2	0.7
9	4	0.3023	0.1111	1		3	21	6.38	2.1	0.6
10	4	0.4061	0.1111	2		2	21	8.57	2.1	0.9
11										
12										
13	1	0.8811	0.0278	1			5	4.65	0.5	0.5
14										
15	4	1.5474	0.1111	1	1	2	21	32.67	2.1	3.3
16	5	1.7797	0.1389	3		2	26	46.97	2.6	4.7
17	5	1.9251	0.1389	4		1	26	50.80	2.6	5.1
18	1	2.2026	0.0278	1			5	11.63	0.5	1.2
19	2	2.6652	0.0556	2			11	28.13	1.1	2.8
20	1	3.4361	0.0278	1			5	18.14	0.5	1.8
21	1	3.7445	0.0278	1			5	19.76	0.5	2.0
Totals	**36**		**1**	**19**	**1**	**16**	**190**	**236.00**	**19.1**	**23.7**

Marked	Captured	Recaps
18	19	1

Length=2991 ft
Width=145 ft
Area=9.96 acres

Population = 190 **CI = 0-386**

CI = ± 196

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	2	8.58	0.228	0.0556	11	2.41	1.1	0.2
Age 2	4	11.04	0.507	0.1111	21	10.71	2.1	1.1
Age 3	3	16.46	1.711	0.0833	16	27.09	1.6	2.7
Age 4	8	17.74	2.128	0.2222	42	89.86	4.2	9.0
Age 5	2	21.26	3.590	0.0556	11	37.90	1.1	3.8

Hatchery Brown Trout

Age 2	1	15.59	1.608	0.0278	5	8.49	0.5	0.9

Wild Rainbow Trout

Age 1	9	8.34	0.220	0.2500	48	10.44	4.8	1.0
Age 2	2	10.45	0.412	0.0556	11	4.35	1.1	0.4
Age 3	2	15.94	1.542	0.0556	11	16.28	1.1	1.6
Age 4	3	16.99	1.799	0.0833	16	28.48	1.6	2.9
Totals	**36**			**1**	**190**	**236.00**	**19.1**	**23.7**

Appendix 5E: Summary of the 2009 trout population study at the Airport Pool on the East Branch.

Airport Pool-2009 July 8-9

4.2 miles below dam 147-147 cfs

Inch Group	Number	Mean Wt(lbs)	Percent	BT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
3	1	0.0183	0.0105	1	2	0.03	0.6	0.0
4	12	0.0378	0.1263	12	19	0.73	7.5	0.3
5	30	0.0649	0.3158	30	48	3.13	18.8	1.2
6	21	0.0932	0.2211	21	34	3.15	13.2	1.2
7	10	0.1481	0.1053	10	16	2.38	6.3	0.9
8	6	0.2409	0.0632	6	10	2.33	3.8	0.9
9	9	0.3253	0.0947	9	14	4.72	5.6	1.8
10	1	0.3778	0.0105	1	2	0.61	0.6	0.2
11	2	0.6049	0.0211	2	3	1.95	1.3	0.8
12	1	0.8811	0.0105	1	2	1.42	0.6	0.6
13								
14								
15								
16								
17								
18	1	2.6211	0.0105	1	2	4.22	0.6	1.6
19	1	3.0396	0.0105	1	2	4.90	0.6	1.9
Totals	**95**		**1**	**95**	**153**	**29.57**	**59.5**	**11.5**

Marked	Captured	Recaps
64	53	22

Station length=1077 ft
Width=104 ft
Acreage=2.57 acres

Population = 153 **CI = 115-191**

CI = ± 38

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	71	5.83	0.076	0.7474	114	8.66	44.5	3.4
Age 2	19	9.05	0.273	0.2000	31	8.36	11.9	3.3
Age 3	3	11.48	0.697	0.0316	5	3.37	1.9	1.3
Age 4	2	18.78	2.830	0.0211	3	9.12	1.3	3.5
Totals	**95**			**1**	**153**	**29.50**	**59.5**	**11.5**

Appendix 5F: Summary of the 2009 trout population study at the T28 Pool on the East Branch.

T28 Pool-2009 July 13-14
6.3 miles below dam 147-151 cfs

Inch Group	Number	Mean Wt(lbs)	Percent	BT	HBT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
3	2	0.0192	0.0147	2		5	0.09	3.2	0.1
4	23	0.0372	0.1691	23		52	1.94	36.7	1.4
5	60	0.0620	0.4412	60		136	8.43	95.7	5.9
6	39	0.0940	0.2868	39		88	8.31	62.2	5.8
7	7	0.1331	0.0515	7		16	2.11	11.2	1.5
8	2	0.2176	0.0147	2		5	0.99	3.2	0.7
9	1	0.2783	0.0074	1		2	0.63	1.6	0.4
10									
11	1	0.4829	0.0074	1		2	1.09	1.6	0.8
12									
13									
14									
15									
16									
17	1	2.3789	0.0074		1	2	5.39	1.6	3.8
Totals	136		**1**	**135**	**1**	**308**	**28.97**	**216.9**	**20.4**

Marked	Captured	Recaps
81	74	19

Station length=653 ft
Width=95 ft
Acreage=1.42 acres

Population = 308 **CI = 208-408**

CI = ± 100

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	133	5.74	0.073	0.9779	301	21.86	212.1	15.4
Age 2	2	10.10	0.381	0.0147	5	1.72	3.2	1.2

Hatchery Brown Trout

Age 3	1	17.40	2.379	0.0074	2	5.39	1.6	3.8
Totals	**136**			**1**	**308**	**28.97**	**216.9**	**20.4**

Appendix 5G: Summary of the 2009 trout population at the Cabin Pool on the East Branch.

Cabin Pool-2009 July 27-28
9.9 miles below dam 203-191 cfs

Inch Group	Number	Mean Wt(lbs)	Percent	BT	HBT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
4	3	0.0367	0.0161	3		9	0.33	2.0	0.1
5	34	0.0655	0.1828	34		103	6.76	22.5	1.5
6	75	0.1002	0.4032	75		228	22.82	49.5	5.0
7	45	0.1479	0.2419	45		137	20.22	29.7	4.4
8	12	0.2154	0.0645	12		36	7.85	7.9	1.7
9	2	0.3191	0.0108	2		6	1.94	1.3	0.4
10	5	0.4277	0.0269	5		15	6.50	3.3	1.4
11	5	0.5334	0.0269	5		15	8.10	3.3	1.8
12	1	0.7269	0.0054	1		3	2.21	0.7	0.5
13									
14									
15	1	1.5859	0.0054		1	3	4.82	0.7	1.0
16									
17									
18	1	2.7753	0.0054	1		3	8.43	0.7	1.8
19									
20	1	3.6784	0.0054	1		3	11.17	0.7	2.4
21	1	3.4361	0.0054	1		3	10.44	0.7	2.3
Totals	**186**		**1**	**185**	**1**	**565**	**111.59**	**122.8**	**24.3**

Marked	Captured	Recaps
120	83	17

Station length=1806 ft
Width=111 ft
Acreage=4.60 acres

Population = 565 **CI = 353-777**

CI = ± 106

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	164	6.62	0.109	0.8817	498	54.34	108.3	11.8
Age 2	18	10.26	0.409	0.0968	55	22.39	11.9	4.9
Age 4	1	18.70	2.775	0.0054	3	8.43	0.7	1.8
Age 5	2	21.26	3.557	0.0108	6	21.61	1.3	4.7

Hatchery Brown Trout

Age 2	1	15.16	1.586	0.0054	3	4.82	0.7	1.0
Totals	**186**			**1**	**565**	**111.59**	**122.8**	**24.3**

Appendix 5H: Summary of the 2009 trout population study at the T22 Pool on the East Branch.

T22 Pool-2009 July 27-28

14.9 miles below dam 203-191 cfs

Inch Group	Number	Mean Wt(lbs)	Percent	BT	HBT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
5	2	0.0644	0.1111	2		4	0.29	2.4	0.2
6	2	0.1091	0.1111	2		4	0.48	2.4	0.3
7	5	0.1372	0.2778	5		11	1.52	5.9	0.8
8	1	0.1951	0.0556	1		2	0.43	1.2	0.2
9									
10									
11	2	0.5423	0.1111	2		4	2.41	2.4	1.3
12	1	0.6608	0.0556	1		2	1.47	1.2	0.8
13									
14									
15	1	1.6079	0.0556		1	2	3.57	1.2	1.9
16									
17	1	2.2907	0.0556		1	2	5.09	1.2	2.7
18	1	1.9824	0.0556	1		2	4.41	1.2	2.3
19	1	2.6432	0.0556	1		2	5.87	1.2	3.1
20	1	3.1498	0.0556	1		2	7.00	1.2	3.7
Totals	**18**		**1**	**16**	**2**	**40**	**32.55**	**21.2**	**17.2**

Marked	Captured	Recaps
15	4	1

Station length=948 ft
Width=87 ft
Acreage=1.89 acres

Population = 40 **CI = 7-73**

CI = ± 33

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	10	6.91	0.123	0.5556	22	2.73	11.8	1.4
Age 2	3	11.71	0.582	0.1667	7	3.88	3.5	2.1
Age 4	2	19.02	2.313	0.1111	4	10.28	2.4	5.4
Age 5	1	20.39	3.150	0.0556	2	7.00	1.2	3.7
Hatchery Brown Trout								
Age 2	2	16.54	1.949	0.1111	4	8.66	2.4	4.6
Totals	**18**			**1**	**40**	**32.55**	**21.2**	**17.2**

Appendix 5I: Summary of the 2009 trout population study at Hasbrouck on the Neversink River.

Hasbrouck July 20-21
2.8 miles below dam 113-113 cfs

Inch Group	Number	Mean Wt (lbs)	Percent	BT	HBT	ST	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
4	1	0.0343	0.0303	1			3	0.11	4.0	0.1
5	6	0.0593	0.1818	6			20	1.19	23.8	1.4
6	13	0.0939	0.3939	11	1	1	43	4.07	51.6	4.8
7	4	0.1321	0.1212	4			13	1.76	15.9	2.1
8	2	0.2084	0.0606			2	7	1.39	7.9	1.7
9										
10	2	0.3824	0.0606	1		1	7	2.55	7.9	3.0
11										
12	1	0.8811	0.0303	1			3	2.94	4.0	3.5
13	1	0.9692	0.0303	1			3	3.23	4.0	3.8
14										
15	1	1.5859	0.0303	1			3	5.29	4.0	6.3
16	1	1.6300	0.0303	1			3	5.43	4.0	6.5
17										
18	1	2.2467	0.0303	1			3	7.49	4.0	8.9
TOTALS	**33**		**1**	**28**	**1**	**4**	**110**	**35.45**	**131.0**	**42.2**

Marked	Captured	Recaps
21	14	2

Length=330 ft
Width=111 ft
Area=0.84 acres

Population = 110 **CI = 20-200**

CI = ± 90

Wild Brown Trout

	Number	Length (in)	Weight (lbs)	Percent	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
Age 1	21	6.14	0.09	0.6364	70	6.06	83.3	7.2
Age 2	4	10.80	0.59	0.1212	13	7.83	15.9	9.3
Age 3	2	17.17	1.92	0.0606	7	12.78	7.9	15.2
Age ?	1	16.54	1.63	0.0303	3	5.43	4.0	6.5
Hatchery Brown Trout								
Age 1	1	6.38	0.09	0.0303	3	0.31	4.0	0.4
Brook Trout								
Age 1	2	7.32	0.15	0.0606	7	0.98	7.9	1.2
Age 2	2	9.41	0.31	0.0606	7	2.06	7.9	2.4
Totals	**33**			**1**	**110**	**35.45**	**131.0**	**42.2**

Appendix 5J: Summary of the 2009 trout population study at Fallsburg on the Neversink River.

Fallsburg - 2009 July 20-21

8.0 miles below dam

Inch Group	Number	Means Wt (lbs)	Percent	BT	HBT	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
5	7	0.0706	0.1842	7		20	1.44	14.0	1.0
6	12	0.0952	0.3158	12		35	3.34	24.0	2.3
7	6	0.1337	0.1579	6		18	2.34	12.0	1.6
8	1	0.2375	0.0263		1	3	0.69	2.0	0.5
9	3	0.3100	0.0789	1	2	9	2.72	6.0	1.9
10	4	0.4139	0.1053	2	2	12	4.84	8.0	3.3
11	1	0.5093	0.0263	1		3	1.49	2.0	1.0
12	2	0.5293	0.0526	2		6	3.09	4.0	2.1
13									
14	1	0.8811	0.0263		1	3	2.57	2.0	1.8
15									
16									
17	1	1.9824	0.0263	1		3	5.79	2.0	4.0
TOTALS	**38**		**1**	**32**	**6**	**111**	**28.31**	**76.0**	**19.4**

Marked	Captured	Recaps
25	16	3

Length=714 ft
Width=89 ft
Area=1.46 acres

Population = 111 **CI = 33-189**

CI = ± 78

Brown Trout

	Number	Mean length (in)	Mean weight (lbs)	Percent	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
Age 1	27	6.75	0.125	0.7105	79	9.85	54.0	6.7
Age 2	4	10.82	0.423	0.1053	12	4.95	8.0	3.4
Age 3	1	17.80	1.982	0.0263	3	5.79	2.0	4.0

Hatchery Brown Trout

Age 1	5	9.87	0.353	0.1316	15	5.16	10.0	3.5
Age 2	1	14.17	0.881	0.0263	3	2.57	2.0	1.8
Totals	**38**			**1**	**111**	**28.31**	**76.0**	**19.4**

Appendix 5K: Summary of the 2009 trout population study at Ranch Road on the Neversink River.

Ranch Road - 2009 July 20-21

12.9 miles below dam 189-181 cfs

Inch Group	Number	Mean Wt (lbs)	Percent	BT	HBT	Estimated N	Biomass (lb)	N/acre	Lb/acre
5	2	0.0673	0.0270	2		4	0.25	7.4	0.5
6									
7	18	0.1463	0.2432	18		33	4.87	66.4	9.7
8	21	0.2244	0.2838	19	2	39	8.72	77.4	17.4
9	12	0.3007	0.1622	5	7	22	6.68	44.3	13.3
10	5	0.3895	0.0676	1	4	9	3.61	18.4	7.2
11	1	0.5366	0.0135		1	2	0.99	3.7	2.0
12	3	0.7628	0.0405	3		6	4.24	11.1	8.4
13	6	1.0095	0.0811	2	4	11	11.21	22.1	22.3
14	1	1.1454	0.0135		1	2	2.12	3.7	4.2
15	1	1.4317	0.0135	1		2	2.65	3.7	5.3
16	3	1.8282	0.0405	3		6	10.15	11.1	20.2
17	1	1.9824	0.0135	1		2	3.67	3.7	7.3
Totals	**74**		**1**	**55**	**19**	**137**	**59.17**	**272.9**	**117.9**

Marked	Captured	Recaps
51	36	13

Length=486 ft
Width=45 ft
Area=0.50 acres

Population = 137 **CI = 90-184**

CI = ± 47

Wild Brown Trout

	Number	Length (in)	Weight (lbs)	Percent	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
Age 1	45	8.05	0.196	0.6081	83	16.30	166.0	32.5
Age 2	5	12.76	0.819	0.0676	9	7.58	18.4	15.1
Age 3	5	16.20	1.780	0.0676	9	16.47	18.4	32.8

Hatchery Brown Trout

Age 1	14	9.76	0.341	0.1892	26	8.83	51.6	17.6
Older	5	13.65	1.079	0.0676	9	9.99	18.4	19.9
Totals	**74**			**1**	**137**	**59.17**	**272.9**	**117.9**

Appendix 6:

UPPER DELAWARE TAILWATERS

2010 Trout Population Studies

West Branch: Appendices 6A to 6D
East Branch: Appendices 6E to 6H
Neversink River: Appendices 6I to 6K

Appendix 6A: Summary of the 2010 trout population study at Stilesville on the West Branch.

Stilesville - 2010 July 12 & 14

2.1 miles below dam 350-407 cfs

Inch Group	Number	Mean Wt(lbs)	Percentage	BT	HBT	RT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
4	22	0.0390	0.0401	22			67	2.61	7.7	0.3
5	127	0.0634	0.2313	126		1	386	24.45	44.6	2.8
6	172	0.0974	0.3133	169		3	523	50.88	60.4	5.9
7	52	0.1464	0.0947	46		6	158	23.12	18.3	2.7
8	8	0.2057	0.0146	7		1	24	5.00	2.8	0.6
9	17	0.3166	0.0310	15	2		52	16.35	6.0	1.9
10	7	0.3956	0.0128	7			21	8.41	2.5	1.0
11	13	0.5679	0.0237	13			39	22.43	4.6	2.6
12	23	0.7661	0.0419	21		2	70	53.54	8.1	6.2
13	21	0.9540	0.0383	17		4	64	60.87	7.4	7.0
14	9	1.1747	0.0164	8		1	27	32.12	3.2	3.7
15	19	1.3656	0.0346	18		1	58	78.83	6.7	9.1
16	13	1.6588	0.0237	13			39	65.52	4.6	7.6
17	24	2.0558	0.0437	22		2	73	149.90	8.4	17.3
18	13	2.3111	0.0237	13			39	91.28	4.6	10.6
19	5	2.6784	0.0091	5			15	40.69	1.8	4.7
20	2	2.8744	0.0036	2			6	17.47	0.7	2.0
21	1	3.3040	0.0018	1			3	10.04	0.4	1.2
22	1	4.3612	0.0018	1			3	13.25	0.4	1.5
Totals	**549**		**1**	**526**	**2**	**21**	**1668**	**766.77**	**192.8**	**88.6**

Marked	Captured	Recaps
310	288	53

Length=1884
Width=200 ft ft
Area=8.65 acres

Population = 1668 **CI = 1,300-2,036**

CI = ±368

Note: Three yearling and one older trout died during the marking effort. These 4 fish were added to the estimated N.

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	351	6.12	0.086	0.6393	1066	91.37	123.3	10.6
Age 2	38	8.93	0.273	0.0692	115	31.56	13.3	3.6
Age 3	70	13.02	0.885	0.1275	213	188.19	24.6	21.8
Age 4	57	17.09	1.888	0.1038	173	327.05	20.0	37.8
Age 5	8	19.00	2.492	0.0146	24	60.56	2.8	7.0
Age 6	2	21.93	3.833	0.0036	6	23.29	0.7	2.7

Hatchery Brown Trout

Age 1	2	9.37	0.298	0.0036	6	1.81	0.7	0.2

Wild Rainbow Trout

Age 1	11	7.23	0.140	0.0200	33	4.69	3.9	0.5
Age 2	1	12.99	0.881	0.0018	3	2.68	0.4	0.3
Age 3	7	13.89	1.106	0.0128	21	23.52	2.5	2.7
Age 4	2	17.76	1.982	0.0036	6	12.05	0.7	1.4
Totals	**549**			**1**	**1668**	**766.77**	**192.8**	**88.6**

Appendix 6B: Summary of the 2010 trout population study at the No Kill on the West Branch.

No Kill - 2010 July 19-20

3.9 miles below dam 520-478 cfs

Inch Group	Number	Mean Wt(lbs)	Percentage	BT	HBT	RT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
4	3	0.0407	0.0075	3			11	0.45	0.6	0.0
5	40	0.0679	0.0998	40			147	9.99	7.7	0.5
6	57	0.0987	0.1421	57			210	20.68	10.9	1.1
7	57	0.1499	0.1421	55		2	210	31.41	10.9	1.6
8	13	0.2061	0.0324	11		2	48	9.85	2.5	0.5
9	11	0.3001	0.0274	11			40	12.13	2.1	0.6
10	16	0.4255	0.0399	12	3	1	59	25.02	3.1	1.3
11	22	0.5540	0.0549	20	2		81	44.80	4.2	2.3
12	24	0.7484	0.0599	23	1		88	66.03	4.6	3.4
13	27	0.9545	0.0673	26		1	99	94.73	5.2	4.9
14	16	1.1495	0.0399	15		1	59	67.61	3.1	3.5
15	20	1.3689	0.0499	20			74	100.64	3.8	5.2
16	19	1.7065	0.0474	17	1	1	70	119.18	3.6	6.2
17	33	2.0208	0.0823	30	1	2	121	245.12	6.3	12.8
18	22	2.3078	0.0549	22			81	186.62	4.2	9.7
19	11	2.5891	0.0274	11			40	104.69	2.1	5.5
20	6	2.7665	0.0150	6			22	61.02	1.1	3.2
21	**3**	3.4508	0.0075	**3**			11	38.05	0.6	2.0
22			0.0000				0	0.00	0.0	0.0
23	1	4.1850	0.0025	1			4	15.38	0.2	0.8
Totals	**401**		**1**	**383**	**8**	**10**	**1474**	**1253.41**	**76.8**	**65.3**

Marked	Captured	Recaps
293	129	25

Length=3428 ft
Width=244 ft
Area=19.20 acres

Population = 1,474 **CI = 991-1,957**

CI = ±483

Note: Three yearling and one older trout died during the marking effort. These 4 fish were added to the estimated N.

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	161	6.66	0.112	0.4015	592	66.08	30.8	3.4
Age 2	42	10.84	0.505	0.1047	154	78.03	8.0	4.1
Age 3	94	13.70	1.006	0.2344	346	347.51	18.0	18.1
Age 4	66	17.73	2.067	0.1646	243	501.50	12.6	26.1
Age 5	17	19.23	2.580	0.0424	62	161.20	3.3	8.4
Age 6	3	21.04	3.326	0.0075	11	36.68	0.6	1.9

Hatchery Brown Trout

Age 1	6	11.33	0.563	0.0150	22	12.41	1.1	0.6
Age 2	1	16.93	1.982	0.0025	4	7.29	0.2	0.4
Age 3	1	17.40	1.982	0.0025	4	7.29	0.2	0.4

Rainbow Trout

Age 1	3	7.69	0.166	0.0075	11	1.83	0.6	0.1
Age 2	2	9.78	0.351	0.0050	7	2.58	0.4	0.1
Age 3	2	14.13	1.123	0.0050	7	8.26	0.4	0.4
Age 4				0.0000				
Age 5	3	17.22	2.023	0.0075	11	22.31	0.6	1.2
Totals	**401**			**1**	**1474**	**1252.95**	**76.8**	**65.3**

Appendix 6C: Summary of the 2010 trout population study at Hale Eddy on the West Branch.

Hale Eddy- 2010 June 28-29

7.9 miles below dam ~490 cfs both days

Inch Group	Number	Mean Wt(lbs)	Percentage	BT	HBT	RT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
4	2	0.0440	0.00559	2			7	0.31	0.4	0.0
5	37	0.0663	0.10335	37			132	8.73	8.2	0.5
6	80	0.0972	0.22346	79		1	284	27.66	17.7	1.7
7	48	0.1506	0.13408	35		13	171	25.71	10.6	1.6
8	15	0.2251	0.04190	9		6	53	12.01	3.3	0.7
9	16	0.3095	0.04469	11		5	57	17.61	3.5	1.1
10	32	0.4142	0.08939	28	2	2	114	47.14	7.1	2.9
11	24	0.5502	0.06704	21		3	85	46.96	5.3	2.9
12	18	0.7900	0.05028	13		5	64	50.57	4.0	3.2
13	11	0.9391	0.03073	5		6	39	36.73	2.4	2.3
14	14	1.1753	0.03911	9		5	50	58.51	3.1	3.6
15	8	1.3161	0.02235	6		2	28	37.44	1.8	2.3
16	12	1.5767	0.03352	10		2	43	67.28	2.7	4.2
17	7	1.9918	0.01955	6		1	25	49.58	1.6	3.1
18	13	2.2552	0.03631	10		3	46	104.25	2.9	6.5
19	8	2.5523	0.02235	6		2	28	72.61	1.8	4.5
20	6	2.9332	0.01676	6			21	62.58	1.3	3.9
21	5	3.1366	0.01397	5			18	55.77	1.1	3.5
22	1	3.3040	0.00279	1			4	11.75	0.2	0.7
23	1	3.7885	0.00279	1			4	13.47	0.2	0.8
Totals	**358**		**1**	**300**	**2**	**56**	**1273**	**806.63**	**79.4**	**50.3**

Marked	Captured	Recaps
199	183	28

Length=4235 ft
Width=165 ft
Area=16.04 acres

Population = 1,273 **CI = 880-1,666**

CI = ±393

Note: Three yearling and one older trout died during the marking effort. These 4 fish were added to the estimated N.

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	143	6.40	0.097	0.3994	508	49.43	31.7	3.1
Age 2	60	9.78	0.361	0.1676	213	77.02	13.3	4.8
Age 3	50	12.79	0.828	0.1397	178	147.27	11.1	9.2
Age 4	33	17.61	1.991	0.0922	117	233.64	7.3	14.6
Age 5	12	20.01	2.753	0.0335	43	117.48	2.7	7.3
Age 6	2	22.34	3.491	0.0056	7	24.83	0.4	1.5

Hatchery Brown Trout

Age 1	2	10.26	0.390	0.0056	7	2.77	0.4	0.2

Rainbow Trout

Age 1	17	7.57	0.158	0.0475	60	9.54	3.8	0.6
Age 2	15	10.31	0.415	0.0419	53	22.14	3.3	1.4
Age 3	17	14.10	1.116	0.0475	60	67.44	3.8	4.2
Age 4	4	17.81	1.905	0.0112	14	27.10	0.9	1.7
Age 5	3	18.95	2.621	0.0084	11	27.96	0.7	1.7
Totals	**358**			**1**	**1273**	**806.63**	**79.4**	**50.3**

Appendix 6D: Summary of the 2010 trout population study at Balls Eddy on the West Branch.

Balls Eddy - 2010 June 23-24

12.7 miles below dam 498-490 cfs

Inch Group	Number	Mean Wt(lbs)	Percentage	BT	HBT	RT	ST	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
5	10	0.0640	0.0952	8		2		28	1.82	2.9	0.2
6	11	0.1012	0.1048	6		5		31	3.17	3.1	0.3
7	10	0.1548	0.0952	8		2		28	4.41	2.9	0.4
8	6	0.2116	0.0571	4		2		17	3.62	1.7	0.4
9	10	0.3168	0.0952	1	1	7	1	28	9.02	2.9	0.9
10	3	0.4240	0.0286	3				9	3.62	0.9	0.4
11	6	0.5710	0.0571	3		3		17	9.76	1.7	1.0
12	4	0.7874	0.0381	2		2		11	8.97	1.1	0.9
13	8	0.9334	0.0762	6		3		23	21.26	2.3	2.1
14	11	1.2315	0.1048	6		5		31	38.57	3.1	3.9
15	9	1.5516	0.0857	3		6		26	39.77	2.6	4.0
16	4	1.8337	0.0381	2		2		11	20.89	1.1	2.1
17	6	2.1402	0.0571	4		2		17	36.57	1.7	3.7
18	4	2.2907	0.0381	4				11	26.09	1.1	2.6
19	2	2.8634	0.0190	1		1		6	16.31	0.6	1.6
20	1	3.3040	0.0095	1				3	9.41	0.3	0.9
Totals	**105**		**1**	**62**	**1**	**42**	**1**	**299**	**253.25**	**30.0**	**25.4**

Marked	Captured	Recaps
68	37	Assume 0

Length=2,991 ft
Width=145 ft
Area=9.96 acres

Population = 299

Note: One yearling trout died during the marking effort. This 1 fish was added to the estimated N.

Note 1: This estimate derived as follows: (M+C/2)/0.176

Note 2: Although 1 marked trout was collected, the estimate was too high to be believable so the estimate was based on 0 recaps.

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	24	6.43	0.098	0.2286	68	6.73	6.9	0.7
Age 2	13	8.29	0.207	0.1238	37	7.67	3.7	0.8
Age 3	10	9.84	0.345	0.0952	28	9.83	2.9	1.0
Age 4	13	11.95	0.674	0.1238	37	24.95	3.7	2.5
Age 5	1	13.27	0.815	0.0095	3	2.32	0.3	0.2

Hatchery Brown Trout

Age 1	1	9.92	0.3521	0.0095	3	1.00	0.3	0.1

Rainbow Trout

Age 1	11	14.01	1.119	0.1048	31	35.06	3.1	3.5
Age 2	15	15.35	1.477	0.1429	43	63.10	4.3	6.3
Age 3	8	17.18	1.988	0.0762	23	45.29	2.3	4.5
Age 4	7	18.83	2.445	0.0667	20	48.74	2.0	4.9
Age 5								
Age 6	1	20.55	3.304	0.0095	3	9.41	0.3	0.9

Brook Trout

Age 2	1	9.25	0.2855	0.0095	3	0.81	0.3	0.1
Totals	**105**			**1**	**299**	**254.92**	**30.0**	**25.6**

Appendix 6E: summary of the 2010 trout population study at the Airport Pool on the East Branch.

Airport Pool-2010 June 21-22

4.2 miles below dam 168-166 cfs

Inch Group	Number	Mean Wt(lbs)	Percent	BT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
3	4	0.0181	0.0248	4	7	0.12	2.6	0.0
4	41	0.0356	0.2547	41	70	2.47	27.1	1.0
5	53	0.0581	0.3292	53	90	5.22	35.0	2.0
6	15	0.0903	0.0932	15	25	2.30	9.9	0.9
7	21	0.1517	0.1304	21	36	5.40	13.9	2.1
8	7	0.2145	0.0435	7	12	2.55	4.6	1.0
9	9	0.3213	0.0559	9	15	4.90	5.9	1.9
10	5	0.4210	0.0311	5	8	3.57	3.3	1.4
11	1	0.5940	0.0062	1	2	1.01	0.7	0.4
12	1	0.7489	0.0062	1	2	1.27	0.7	0.5
13	1	0.9031	0.0062	1	2	1.53	0.7	0.6
14								
15	1	1.5419	0.0062	1	2	2.61	0.7	1.0
16								
17								
18								
19								
20	1	2.9075	0.0062	1	2	4.93	0.7	1.9
21								
22	1	3.8326	0.0062	1	2	6.50	0.7	2.5
Totals	**161**		**1**	**161**	**273**	**44.39**	**106.2**	**17.3**

Marked	Captured	Recaps
119	74	32

Station length=1077 ft
Width=104 ft
Acreage=2.57 acres

Population = 273 **CI = 213-333**

CI=± 60

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	113	5.18	0.053	0.7019	192	10.12	74.6	3.9
Age 2	41	8.39	0.225	0.2547	70	15.61	27.1	6.1
Age 3	4	13.05	0.879	0.0248	7	5.96	2.6	2.3
Age 4	1	12.60	0.749	0.0062	2	1.27	0.7	0.5
Age 5	1	20.71	2.907	0.0062	2	4.93	0.7	1.9
Age 6	1	22.13	3.833	0.0062	2	6.50	0.7	2.5
Totals	**161**			**1**	**273**	**44.39**	**106.2**	**17.3**

Appendix 6F: Summary of the 2010 trout population study at the T28 Pool on the East Branch.

T28 Pool-2010 July 1-2
6.3 miles below dam 149-147 cfs

Inch Group	Number	Mean Wt(lbs)	Percent	BT	ST	RT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
3	1	0.0227	0.0048	1			3	0.06	2.0	0.0
4	42	0.0389	0.2029	42			119	4.62	83.7	3.3
5	117	0.0608	0.5652	116	1		331	20.15	233.3	14.2
6	40	0.0905	0.1932	40			113	10.24	79.7	7.2
7	3	0.1520	0.0145	3			8	1.29	6.0	0.9
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19	2	2.2026	0.0097	1		1	6	12.47	4.0	8.8
20	1	3.3700	0.0048	1			3	9.54	2.0	6.7
21	1	3.9648	0.0048	1			3	11.22	2.0	7.9
Totals	**207**		**1**	**205**	**1**	**1**	**586**	**69.60**	**412.7**	**49.0**

Marked	Captured	Recaps
132	96	21

Station length=653 ft
Width=95 ft
Area=1.42 acres

Population = 586 **CI = 390-782**

CI = ± 196

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	200	5.51	0.062	0.9662	566	35.28	398.7	24.8
Age 2	2	7.70	0.165	0.0097	6	0.93	4.0	0.7
Age 5	3	20.42	3.172	0.0145	8	26.94	6.0	19.0

Rainbow Trout

Age 6	1	19.80	2.225	0.0048	3	6.30	2.0	4.4

Brook Trout

Age 1	1	5.35	0.055	0.0048	3	0.16	2.0	0.1
Totals	**207**			**1**	**586**	**69.60**	**412.7**	**49.0**

Appendix 6G: Summary of the 2010 trout population study at the Cabin Pool on the East Branch.

Cabin Pool-2010 July 6-8
9.9 miles below dam 179-158 cfs

Inch Group	Number	Mean Wt(lbs)	Percent	BT	HBT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
4	5	0.5790	0.0202	5		23	13.18	4.9	2.9
5	99	0.0634	0.3992	99		451	28.56	98.0	6.2
6	108	0.0940	0.4355	108		492	46.21	106.9	10.0
7	21	0.1384	0.0847	21		96	13.23	20.8	2.9
8	1	0.1393	0.0040	1		5	0.63	1.0	0.1
9	3	0.1883	0.0121	2	1	14	2.57	3.0	0.6
10	3	0.3224	0.0121	3		14	4.40	3.0	1.0
11	1	0.4427	0.0040	1		5	2.02	1.0	0.4
12	1	0.4676	0.0040	1		5	2.13	1.0	0.5
13	1	0.5534	0.0040	1		5	2.52	1.0	0.5
14	2	0.8260	0.0081		2	9	7.52	2.0	1.6
15	2	1.2775	0.0081	2		9	11.63	2.0	2.5
16	1	1.6079	0.0040	1		5	7.32	1.0	1.6
Totals	**248**		**1**	**245**	**3**	**1129**	**141.93**	**245.4**	**30.9**

Marked	Captured	Recaps
153	109	14

Station length=1806 ft
Width=111 ft
Area=4.60 acres

Population = 1129 **CI = 630-1628**

CI = ± 499

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	230	6.10	0.084	0.9274	1047	88.28	227.6	19.2
Age 2	11	9.59	0.347	0.0444	50	17.38	10.9	3.8
Age 3	2	14.49	1.134	0.0081	9	10.33	2.0	2.2
Age 4	2	15.93	1.432	0.0081	9	13.04	2.0	2.8

Hatchery Brown Trout

Age 1	1	9.17	0.278	0.0040	5	1.27	1.0	0.3
Age 2	2	14.76	1.278	0.0081	9	11.63	2.0	2.5
Totals	**248**			**1**	**1129**	**141.93**	**245.4**	**30.9**

Appendix 6H: Summary of the 2010 trout population study at the T22 Pool on the East Branch.

T22 Pool-2010 Aug 19-20
14.9 miles below dam 143-142 cfs

Inch Group	Number	Mean Wt(lbs)	Percent	BT	RT	HRT	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
4	1	0.3041	0.0526	1			2	0.48	0.8	0.3
5										
6	1	1.0352	0.0526	1			2	1.63	0.8	0.9
7	2	1.7841	0.1053	2			3	5.63	1.7	3.0
8	5	0.1221	0.2632	5			8	0.96	4.2	0.5
9	1	0.2037	0.0526		1		2	0.32	0.8	0.2
10										
11	1	0.2186	0.0526	1			2	0.35	0.8	0.2
12	1	0.2186	0.0526	1			2	0.35	0.8	0.2
13	1	0.2343	0.0526	1			2	0.37	0.8	0.2
14	2	0.5987	0.1053	1	1		3	1.89	1.7	1.0
15	1	0.9251	0.0526	1			2	1.46	0.8	0.8
16										
17	2	1.3326	0.1053		1	1	3	4.21	1.7	2.2
18										
19	1	3.3040	0.0526	1			2	5.22	0.8	2.8
Totals	**19**		**1**	**15**	**3**	**1**	**30**	**22.87**	**15.9**	**12.1**

Marked	Captured	Recaps
14	9	4

Station length=948 ft
Width=87 ft
Area=1.89 acres

Population = 30 **CI = 16-44**

CI = ± 14

Wild Brown Trout

	Number	Length(in)	Weight(lbs)	Percent	Estimated N	Biomass(lbs)	N/acre	Lbs/acre
Age 1	9	7.49	0.165	0.4737	14	2.35	7.5	1.2
Age 2	2	12.11	0.599	0.1053	3	1.89	1.7	1.0
Age 3	3	14.66	1.197	0.1579	5	5.67	2.5	3.0
Age 5	1	19.76	3.304	0.0526	2	5.22	0.8	2.8

Rainbow Trout

Age 2	2	11.81	0.670	0.1053	3	2.11	1.7	1.1
Age 5	1	17.80	1.806	0.0526	2	2.85	0.8	1.5

Hatchery Rainbow Trout

Age 3	1	17.72	1.762	0.0526	2	2.78	0.8	1.5
Totals	**19**			**1**	**30**	**22.87**	**15.9**	**12.1**

Appendix 6I: Summary of the 2010 trout population study at Hasbrouck on the Neversink River.

Hasbrouck - 2010 August 2-4

2.8 mi below dam 95-98 cfs

Inch Group	Number	Mean Wt (lbs)	Percent	BT	HBT	Estimated N	Biomass (lbs)	N/acre	Lb/acre
5	2	0.0490	0.1111	2		4	0.20	4.9	0.2
6	3	0.1159	0.1667	3		6	0.72	7.4	0.9
7	3	0.1334	0.1667	3		6	0.83	7.4	1.0
8	1	0.1840	0.0556	1		2	0.38	2.5	0.5
9	1	0.2783	0.0556	1		2	0.58	2.5	0.7
10									
11									
12									
13	1	0.7709	0.0556	1		2	1.60	2.5	1.9
14	1	1.4097	0.0556	1		2	2.92	2.5	3.5
15									
16	1	1.8722	0.0556		1	2	3.88	2.5	4.6
17	3	2.0705	0.1667	3		6	12.88	7.4	15.3
18	1	2.0925	0.0556	1		2	4.34	2.5	5.2
19	1	2.9956	0.0556	1		2	6.21	2.5	7.4
Totals	**18**		**1**	**17**	**1**	**37**	**34.56**	**44.4**	**41.1**

Marked	Captured	Recaps
13	7	2

Length=330 ft
Width=111 ft
Area=0.84 acres

Population = 37 **CI = 11-63**

CI = ± 26

Wild Brown Trout

	Number	Length (in)	Weight (lbs)	Percent	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
Age 1	8	6.55	0.106	0.4444	17	1.75	19.8	2.1
Age 2	2	11.06	0.231	0.1111	4	0.96	4.9	1.1
Age 3	2	13.82	1.090	0.1111	4	4.52	4.9	5.4
Age 4	3	18.52	2.504	0.1667	6	15.58	7.4	18.5
Age ?	2	17.24	1.894	0.1111	4	7.86	4.9	9.4

Hatchery Brown Trout

Age 2	1	16.34	1.872	0.0556	2	3.88	2.5	4.6
Totals	**18**			**1**	**37**	**34.56**	**44.4**	**41.1**

Appendix 6J: Summary of the 2010 trout population study at Fallsburg on the Neversink River.

Fallsburg - 2010 August 3-4

8.0 miles below dam

Inch Group	Number	Mean Wt (lbs)	Percent	BT	HBT	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
5	6	0.0657	0.1622	6		13	0.86	9.0	0.6
6	14	0.0956	0.3784	14		31	2.93	21.0	2.0
7	6	0.1471	0.1622	6		13	1.93	9.0	1.3
8	1	0.1980	0.0270		1	2	0.43	1.5	0.3
9	4	0.3158	0.1081	1	3	9	2.77	6.0	1.9
10									
11									
12	1	0.7269	0.0270	1		2	1.59	1.5	1.1
13									
14									
15	3	1.3803	0.0811	3		7	9.07	4.5	6.2
16	1	1.7181	0.0270		1	2	3.76	1.5	2.6
17	1	1.7621	0.0270	1		2	3.86	1.5	2.6
Totals	**37**		**1**	**32**	**5**	**81**	**27.20**	**55.5**	**18.6**

Marked	Captured	Recaps
22	20	5

Length=714 ft
Width=89 ft
Area=1.46 acres

Population = 81 **CI = 38-124**

CI = ± 43

Brown Trout

	Number	Length (in)	Weight (lbs)	Percent	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
Age 1	27	6.6	0.11	0.7297	59	6.31	40.5	4.3
Age 2	2	13.9	1.07	0.0541	4	4.68	3.0	3.2
Age 4	2	16.6	1.54	0.0541	4	6.75	3.0	4.6
Age ?	1	15.7	1.41	0.0270	2	3.09	1.5	2.1
Hatchery Brown Trout								
Age 1	3	9.2	0.28	0.0811	7	1.86	4.5	1.3
Age 2	1	9.8	0.34	0.0270	2	0.75	1.5	0.5
Age 3	1	16.5	1.72	0.0270	2	3.76	1.5	2.6
	37			**1**	**81**	**27.20**	**55.5**	**18.6**

Appendix 6K: Summary of the 2010 trout population study at Ranch Road on the Neversink River.

Ranch Road - 2010 August 3-4

12.9 miles below dam 119-119 cfs

Inch Group	Number	Mean Wt (lbs)	Percent	BT	HBT	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
5	1	0.0743	0.0116	1		2	0.15	3.9	0.3
6	1	0.1179	0.0116	1		2	0.23	3.9	0.5
7	17	0.1537	0.1977	17		33	5.14	66.5	10.2
8	20	0.2174	0.2326	19	1	39	8.55	78.3	17.0
9	5	0.3038	0.0581	5		10	2.98	19.6	5.9
10	14	0.4080	0.1628	4	10	28	11.22	54.8	22.4
11	7	0.5700	0.0814	6	1	14	7.84	27.4	15.6
12	12	0.6467	0.1395	12		24	15.25	47.0	30.4
13	5	0.8379	0.0581	4	1	10	8.23	19.6	16.4
14	1	1.1013	0.0116	1		2	2.16	3.9	4.3
15	1	1.3559	0.0116		1	2	2.66	3.9	5.3
16	1	1.5859	0.0116		1	2	3.12	3.9	6.2
17	1	1.6960	0.0116	1		2	3.33	3.9	6.6
Totals	**86**		**1**	**71**	**15**	**169**	**70.87**	**336.7**	**141.2**

Marked	Captured	Recaps
63	36	13

Length=486 ft
Width=45 ft
Area=0.50 acres

Population = 169 **CI = 109-229**

CI = ± 60

Wild Brown Trout

	Number	Length (in)	Weight (lbs)	Percent	Estimated N	Biomass (lbs)	N/acre	Lbs/acre
Age 1	43	8.13	0.200	0.5000	85	16.92	168.3	33.7
Age 2	26	12.04	0.629	0.3023	51	32.14	101.8	64.0
Age 3	2	15.39	1.292	0.0233	4	5.08	7.8	10.1

Hatchery Brown Trout

Age 1	12	10.28	0.399	0.1395	24	9.40	47.0	18.7
Older	3	14.90	1.244	0.0349	6	7.33	11.7	14.6
Totals	**86**			**1**	**169**	**70.87**	**336.7**	**141.2**