Attachment B

Sargent and Lundy, 2010
Evaluation 2009-14662

The Effect of the Prairie Island Power Uprate on the Ice Thickness in Lake Pepin

Evaluation 2009-14662
The Effect of the Prairie Island Power Uprate on the Ice Thickness in Lake Pepin

Northern States Power
Prairie Island
Not Safety Related
No Unverified Assumptions
Status: Approved

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1.0 Purpose and Background

Lake Pepin is a natural lake along the Mississippi River on the border of Minnesota and Wisconsin. It is a popular site for wintertime recreation including ice fishing, ice sailing, and snowmobiling. The Prairie Island Nuclear Generating Plant is approximately thirteen miles up river from the head waters of Lake Pepin. The Army Corps of Engineers' Lock and Dam #3 is immediately downstream of the Prairie Island plant. A few miles downstream of the Lock and Dam, the river splits into two branches described as the mainstem and the Wisconsin Channel. These two branches both feed directly into Lake Pepin. Starting in 1983 when Prairie Island was issued a permit to operate in a once-through cooling mode during the winter season, the impact of the plant's thermal discharge into the river on the formation of ice in Lake Pepin has been of concern.

To address this concern, the Lake Pepin ice thicknesses were monitored by plant personnel from 1981 to 1986. These measurements were followed by a study [4.1] by Heinz Stefan of the Saint Anthony Falls Hydraulic Laboratory of the University of Minnesota. This study developed a thermal model of the river between the plant and the lake that was used to determine the amount of the plant discharge energy that was carried to the head waters of the lake. It was concluded that a residual portion of the plant discharge energy was transferred to Lake Pepin, and that the amount of energy transferred was highly dependent on the weather conditions. A validation of this model was not possible in the study since no temperature data at the headwaters of the lake was available. It was also noted that ice thicknesses measured on Lake Pepin do not seem to respond to the large variations in residual heat input. This may in part be due to the warm river water flowing through the lake as a submerged, stratified flow below the ice layer. Lastly, it was determined in the study that the systematic monitoring of the Lake Pepin ice thicknesses was no longer required. The decision to discontinue the ice thickness monitoring was approved by the Minnesota Department of Natural Resources in November 1987 [4.11].

Prairie Island is presently applying for an extended power uprate (EPU) that will increase its thermal power by approximately ten percent. With this power uprate comes renewed concerns about the impact of the plant thermal discharge on the ice thickness in Lake Pepin. As part of the application process, additional analyses of the plant's effect on the lake ice thickness have been requested.

The purpose of this evaluation is to determine what impact the Prairie Island EPU will have on the formation of ice in Lake Pepin. This evaluation will be done using two different methods. The first method involves recreating the thermal model of the Mississippi River documented in the Stefan report [4.1] and comparing it to Lake Pepin head water temperature data found in a Minnesota Department of Natural Resources investigational report [4.2] written in 1999. The impact of EPU will then be determined by using the river thermal model to analyze the winter of 2006/07 with both current and EPU conditions. The second method used to measure the impact of EPU on the formation of ice in Lake Pepin involves comparing historical Lake Pepin ice data to correlations developed by the St. Anthony Falls Laboratory in 2004 [4.3] that relate ice formation data in 143 lakes to climatic, geographic, and bathymetric data. If the ice formation in Lake Pepin can accurately be predicted by the correlations, it can be inferred that the Prairie Island thermal discharge has minimal impact on the ice cover of the lake.

2.0 Inputs

2.1 Meteorological variables (air temperature, wind speed, relative humidity) are taken from National Weather Service data recorded at the Minneapolis-St. Paul International Airport at three hour intervals. The airport is approximately 40 miles from the headwaters of Lake Pepin. The data from 1979 to 2008 are included in Attachment E (See Section 8.0).

2.2 The river thermal model described in section 6.1 determines the heat loss from the surface of the river between Lock and Dam #3 and the headwaters of Lake Pepin. The daily upstream river temperature data used as the inlet boundary condition of the river thermal model is taken from the Prairie Island historical data measured at Lock and Dam #3, ERCS (Emergency Response Computer System) [4.9] data point 1T2528A. To measure the thermal impact of the plant on the river, river temperature data from upstream of the plant is compared to the measured and predicted river temperatures downstream of the plant. The daily river temperature data upstream of the plant is taken from the Prairie Island historical data measured at Diamond Bluff. The data is included in Attachment E (See Section 8.0).

2.3 The river geometry used in the thermal model is taken from Table 5.1 of the Stefan Study [4.1]

Table 2-1 – Summary of River Geometry

	Length (miles)	Average Width (feet)	Total Surface Area (square miles)	Average Depth at 10,000 ft^3/s (feet)
Upstream Mainstem	3.04	800	0.461	11.7
Downstream Mainstem	8.0	730	1.106	11.7
Wisconsin Channel	6.8	620	0.798	6.8

2.4 The latitude, elevation, surface area, and mean depth of Lake Pepin are taken from Appendix A of [4.5].

Latitude = 44.55 °N
Elevation = 204.00 meters
Surface Area = 101.42 km^2
Mean Depth = 5 meters

2.5 The historical discharge flow rate and discharge temperature from Prairie Island are taken from ERCS [4.9] data points 1U1835A and 1T2530A respectively. The ERCS data is included in Attachment E (See Section 8.0).

2.6 The historical flow through Lock and Dam #3 is taken from the Army Corps of Engineers website [4.10]. The data is included in Attachment E (See section 8.0).

3.0 Assumptions

3.1 It is assumed in the development of the thermal model in section 5.1 that the river geometry found in Input 2.3 is still valid. Any change in channel width would proportionally change the surface area available for heat transfer from the river. However, it is believed that any changes in the river geometry that have occurred since Reference 4.1 was completed are not significant enough to substantially change the results of this analysis. This belief is supported by the comparison of the river thermal model with physical data described in section 6.1.

3.2 The river thermal model developed in section 5.1 is a one dimensional model and therefore assumes that there is perfect thermal mixing throughout the river's cross-section at every point along its length. While a transient, three dimensional model of the river would potentially be more accurate, the effort needed to develop such a model is not justified by the increase in accuracy. This is supported by the comparison of the river thermal model with physical data described in section 6.1.

4.0 References

4.1 Residual Heat Input From the Mississippi River To Lake Pepin During the Winters of 1981/82 to 1985/86, H. G. Stefan, St. Anthony Falls Hydraulic Laboratory, September 1987, included in Attachment E.

4.2 Seasonal Distribution, Habitat Use, And Spawning Locations of Walleye Stizostedion Vitreum And Sauger S. Canadense in Pool 4 of The Upper Mississippi River, With Special Emphasis on Winter Distribution Related to a Thermally Altered Environment, Brian S. Ickes, University of Minnesota, Department of Fisheries and Wildlife, Investigational Report 481, 1999, included in Attachment E.

4.3 Dependence of Lake Ice Covers on Climatic, Geographic, and Bathymetric Variables, Greg Williams, Kari L. Layman, Heinz G. Stefan, St Anthony Falls Hydraulic Laboratory, published in Cold Regions Science and Technology, volume 40, pages 145-164, accepted June 28, 2004, included in Attachment E.

4.4 Winter-Regime Thermal Response of Heated Streams, Paily, Macagno, and Kennedy, Journal of the Hydraulics Division, April 1974, included in Attachment E.

4.5 The Effects of Climate, Lake Morphometry, and Geographic Location on Freshwater lake Ice Covers, Master's Thesis for University of Minnesota, Kari Lynn Layman, February 2001.

4.6 US Army Corps of Engineers website, Lake Pepin Ice Measurements, downloaded 9/18/2009, http://www.mvp.usace.army.mil/navigation/default.asp?pageid=188, see Attachment C.

4.7 Minnesota State Climatology Working Group website, Minnesota's Lake Ice-Out Status, downloaded 11/03/2009, http://climate.umn.edu/search/search.asp?qt=ice, see Attachment D.

4.8 Prairie Island Nuclear Generating Plant Environmental Monitoring Program Annual Reports 1981-1985, Lake Pepin Ice and Water Temperature Survey, see Attachment B.

4.9 Prairie Island ERCS database, Emergency Response Computer System, see Attachment E.

4.10 US Army Corps of Engineers website, Lock and Dam #3, downloaded 10/6/2009,

http://www.mvp-wc.usace.army.mil/projects/Lock3.shtml, see Attachment E.

4.11 Letter to G. V. Welk, Northern States Power from Ronald D. Harnack, Minnesota Department of Natural Resources, November 30, 1987, see Attachment F.

4.12 US Geological Survey, Upper Midwest Environmental Sciences Center website, http://www.umesc.usgs.gov/data_library/water_quality/water1_query.shtml, Lake Pepin Water Quality Data, Field Station 1, Lake City MN, Location Codes M766.0B through M786.5D, see Attachment E.

5.0 Methodology

5.1 River Thermal Model

Three thermal models are presented by Stefan in his study of the heat input into Lake Pepin [4.1]. His preferred model was developed by Paily, et al [4.4] specifically for winter water conditions when there is no ice cover. In this model, the net heat transfer from the surface of the water is approximated by equations 4.13, 4.19, and 4.21 of [4.1].

$$S = -(\varepsilon T + \eta) \qquad \text{Equation 1}$$

where: S = net heat transfer (cal/cm^2/day)
ε = heat exchange coefficient (cal/cm^2/day/°C)
T = water temperature (°C)
η = the base heat exchange rate at a stream temperature of 0 °C (cal/cm^2/day)

$$\varepsilon = 30.912 - 1.088T_a + 3.1522W - 0.03RH \qquad \text{Equation 2}$$

$$\eta = -0.00761 * T_a \times W \times RH - 1.7935 * T_a * W - 0.03 * T_a * RH - 25.0 * T_a - 0.15921 * W * RH + 16.6865 * W - 0.93 * RH - 15.0 \qquad \text{Equation 3}$$

where: T_a = air temperature (°C)
W = wind speed (mph)
RH = relative humidity (%)

The flow split between the downstream mainstem (Q_m) and the Wisconsin Channel (Q_w) is determined by Stefan using equations 5.1 and 5.2 of [4.1].

$$Q_m = 0.0000041Q^2 + 0.5437Q + 1195.94 \qquad \text{Equation 4}$$

$$Q_w = Q - Q_m \qquad \text{Equation 5}$$

where: Q = total flow in river (gpm)

The change in river temperature is found using equation 2.2 from [4.1].

$$dT = \frac{S}{\rho c_p h}\frac{dx}{u} \qquad \text{Equation 6}$$

where: ρ = density (g/cm^3)
c_p = specific heat of water (cal/(g*°C)
h = depth of water (cm)
u = velocity of flow (cm/day)
dT = change in temperature (°C)
dx = length of control volume (cm)

Equations 1 through 6 have been used in an Excel spreadsheet that replicates Stefan's preferred thermal model. The spreadsheet is included as attachment A and the individual runs of the

spreadsheet are included in Attachment E. The meteorological variables (air temperature, wind speed, relative humidity) are taken from National Weather Service data recorded at the Minneapolis-St. Paul International Airport at three hour intervals, Input 2.1. The daily upstream river temperature data used as the inlet boundary condition is taken from the Prairie Island historical data measured at Lock and Dam #3, Input 2.2. The river geometry used in the thermal model is taken from Table 5.1 of the Stefan Study [4.1] and reproduced in Input 2.3.

In the spreadsheet, the three branches of the river are discritized into several rows of cells. The number of rows for each branch is determined by setting the transit time for each cell to one tenth of an hour at a flow rate of 10,000 ft^3/s (Input 2.3). The thermal model is executed by running a macro which advances virtual slugs of water one row each time step. The macro updates the meteorological data once every three hours and the inlet river temperature daily. The water temperature in each cell is initialized to the upstream water temperature on the first day of the transient.

5.2 Impacts of Climate, Geography and Bathymetry

The thickness and duration of ice cover on most lakes is controlled mainly by climatic, geographic, and bathymetric variables [4.3]. At Lake Pepin there is a possibility that the proximity of the Prairie Island plant also has an impact on the ice cover duration and thickness. The significance of the impact of the plant on Lake Pepin's ice cover can be assessed by comparing ice cover data from Lake Pepin to predictions made with the correlations found in Reference 4.3.

Williams, Layman, and Stefan analyzed the dependence of lake ice covers on the climatic, geographic, and bathymetric variables in Reference 4.3 for 143 lakes in Minnesota, Wisconsin, Canada, and Alaska. Using historical data, correlations were developed that can be used to predict the ice in date, ice out date, and maximum ice thickness if such variables as daily air temperature, lake latitude, lake elevation, lake average depth, and lake surface area are known. Data is available for Lake Pepin for two of the ice cover variables analyzed in Reference 4.3: ice out date and maximum ice thickness. If the ice out date and maximum ice thickness data from Lake Pepin can be accurately predicted using the correlations from Reference 4.3, then it can be said that the thermal discharge from Prairie Island does not have a significant impact on the ice cover of Lake Pepin.

Ice Out Date Correlations

The ice out date of a lake is most often considered to be the day on which the lake becomes free of ice. For Lake Pepin the ice out date is often taken as the first day in spring in which the Mississippi barge traffic can once again transit the lake on its way north towards St. Paul. Three correlations for ice out date were documented in Reference 4.3. These are listed as equations 19, 21, and 23 in Table 9 of Reference 4.3. They are shown here as Equations 7-9. The standard errors for Equations 7 through 9 are 8.7, 11.2, and 11.7 days respectively.

$$IOD = -3.81 * FT2 + 1.08 * LAT + 0.02 * ELEV + 0.07 * H_{MEAN} + 0.013 * A_s + 69.6 \qquad \text{Equation 7}$$

$$IOD = 2.89 * LAT + 0.028 * ELEV + 0.011 * H_{MEAN} + 0.031 * A_s - 37.8 \qquad \text{Equation 8}$$

$$IOD = -6.237 * FT2 + 0.048 * H_{MEAN} + 0.002 * A_s + 140.9 \qquad \text{Equation 9}$$

Where: FT2 = mean air temperature from February 1 to June 30 (°C)
LAT = latitude (° North)

ELEV = elevation (m)
H_{MEAN} = average depth (m)
A_s = lake surface area (km^2)
IOD = ice out date (Julian Days)

Maximum Ice Thickness Correlations

Ice growth on the surface of a lake happens mainly through two mechanisms: freezing of the lake water at the bottom of the ice cover and the freezing of snow which accumulates on top of the ice cover. Ice growth normally occurs rapidly and then plateaus for a period of weeks in the middle of the winter. Four correlations are documented in Reference 4.3 for maximum ice thickness. Two of these correlations included accumulated snow fall as an independent variable while the other two do not. Equations 31, 33, 35 and 37 in Table 9 of Reference 4.3 are included here as Equations 10 through 13. The standard errors for Equations 10 through 13 are 12.9, 12.3, 13.1 and 12.3 centimeters respectively.

$$MIT = -0.561 * FT3 + 2.43 * LAT + 0.03 * ELEV + 0.137 * H_{MEAN} - 0.031 * S - 69 \quad \text{Equation 10}$$

$$MIT = 2.73 * LAT + 0.032 * ELEV + 0.052 * H_{MEAN} + 0.03 * S - 86 \quad \text{Equation 11}$$

$$MIT = -0.693 * FT3 + 2.32 * LAT + 0.032 * ELEV + 0.169 * H_{MEAN} - 61 \quad \text{Equation 12}$$

$$MIT = 2.73 * LAT + 0.03 * ELEV + 0.135 * H_{MEAN} - 89 \quad \text{Equation 13}$$

Where: FT3 = mean air temperature from September 1 to June 30 (°C)
LAT = latitude (° North)
ELEV = elevation (m)
H_{MEAN} = average depth (m)
S = snow depth on lake ice cover measured coincident with maximum ice thickness (cm)
MIT = maximum ice thickness (cm)

5.3 Acceptance Criteria

There are no acceptance criteria for this evaluation.

6.0 Calculations

6.1 Comparison of the River Thermal Model to Physical Data

In 1999 the Minnesota Department of Natural Resources (DNR) published a report [4.2] which studied the winter distribution of walleye and sauger in Lake Pepin. As part of this study, temperatures were simultaneously measured upstream of the Prairie Island plant and at the ends of the Downstream Mainstem and Wisconsin branches of the Mississippi River just before they flow into Lake Pepin from November 1, 1998 until February 15, 1999. The measured temperature difference between a point upstream of the plant and the headwaters of Lake Pepin are plotted against the plant operating capacity in Figure 16 of Reference 4.4 which is reproduced as Figure 6-1 below. Using the data in this figure, the DNR report concludes that while only one unit of the plant is operating, the energy discharged by the plant into the river is dissipated before it reaches Lake Pepin, but that when both units are operating the river water at the end of the Downstream Mainstem branch is 0.84 degrees Celsius above the upstream temperature and the Wisconsin Channel temperature is 0.37 degree Celsius above the upstream temperature.

To test the accuracy of the river thermal model described in section 5.1, results from the spreadsheet for the winter of 1998/99 are shown in Figure 6-2 and compared to the DNR report data in Figure 6-3. The temperatures upstream of the plant used in the spreadsheet for comparison were measured at Diamond Bluff (Input 2.2). November 1, 1998 is defined as Day 0. The figure shows that the thermal model predictions compare favorably with the physical data. The only significant difference noted is that the thermal model shows the Wisconsin Channel temperature and the Downstream Mainstem temperature being nearly equal throughout the analyzed time span while the physical data shows some separation of the two temperature readings especially after approximately day 78. The thermal model results in temperature trends similar to the physical data and on average over-predicts the water temperature when there is a disagreement with the physical data.

While preparing this spreadsheet, it was noticed that two of the inputs which greatly affect the thermal response of the river had considerable variation during the analyzed time period. First, around December 20, 1998, the flow through Lock and Dam #3 decreased from approximately 20,000 ft^3/s to 10,000 ft^3/s (Input 2.6). The change in flow rate was addressed in the thermal model by using one spreadsheet (Paily Nov 1 1998 Dec 20 1998 20000cfs.xls) with a constant 20,000 ft^3/s flow rate for the fifty days before December 20 and another spreadsheet (Paily Dec 21 1998 Feb 15 1999 10000cfs.xls) with a constant 10,000 ft^3/s flow rate for the remainder of the time span. The second greatly varying input that impacted the thermal model was the air temperature. For a twenty five day span starting on December 20 the average hourly air temperature was 5 °F. This causes a large amount of thermal energy to be extracted from the river. In Figure 6-2, it can be seen that during this span of low air temperatures the thermal model actually predicts river temperatures significantly below the freezing point. Since water temperatures below the freezing point are not physical, the thermal model results were limited to the freezing point when Figure 6-3 was created.

The variation in river flow rate and the span of low air temperatures in part explain why the river temperatures appear to respond much more to two unit operation at Prairie Island than one unit operation. When one unit is operating before December 20, the flow rate of the river is around 20,000 ft^3/s. This higher flow rate tends to lessen the temperature difference in the river due to the thermal discharge of the plant. After December 20 the flow rate of the river decreases to around 10,000 ft^3/s but the air temperature also falls considerably. The span of low air temperature causes all of the river temperature measurements to be close to the freezing point. With all the water temperatures close to the freezing point, the temperature difference due to the thermal discharge of

the plant is minimized. By the time two unit operation begins around January 12, 1999 (day 73 in the thermal model) the span of low air temperature is ending and the river flow rate is low. Both of these variations tend to maximize the temperature difference due to the thermal discharge of the plant. None of these relationships between flow rate, air temperature, and number of units operating were recognized in the DNR report [4.2].

6.2 Impact of EPU on River Temperatures

The thermal model of the Mississippi River between Lock and Dam #3 and the head waters of Lake Pepin is here used to analyze the impact of the proposed Extended Power Uprate (EPU) on the temperature of the water entering Lake Pepin. This is done by modeling the river temperatures for the winter of 2006/07 under current plant heat load and with EPU. The power uprate is assumed to increase the thermal discharge of Prairie Island into the river by 10%. The thermal discharge of the plant into the river is determined by plotting the product of the plant discharge flow rate and the temperature difference between the plant intake and discharge. These values are taken from the plant ERCS database [4.9]. As seen in Figure 6-4, during the month of January 2007 the average energy discharge from the plant into the river was 36,750 °F * ft^3/s. At a river flow rate of 10,000 ft^3/s, this is the equivalent of a 3.675 °F (2.04 °C) temperature increase for the river. This is consistent with the average observed temperature difference between Lock and Dam #3 and Diamond Bluff. The additional increase in water temperature due to a 10% increase in power due to EPU should therefore be expected to be 0.204 °C at a river flow rate of 10,000 ft^3/s. Figures 6-5 and 6-6 show the nearly identical results of the thermal model run before (Paily Nov 2006 Feb 2007.xls) and after EPU (Paily Nov 2006 Feb 2007 EPU.xls) for the winter of 2006/07 at a river flow rate of 10,000 ft^3/s. Figure 6-7 shows the predicted increase in the water temperature at the headwaters of Lake Pepin due to EPU. As can be seen, it is predicted that EPU will add just below 0.2 °C to the water temperature at a river flow rate of 10,000 ft^3/s. As the river flow rate varies, the water temperature difference due to EPU will vary inversely. At a river flow rate of 20,000 ft^3/s EPU should be expected to add approximately 0.1°C to the water temperature while at a river flow rate of 5,000 ft^3/s EPU should be expected to add approximately 0.4°C to the water temperature.

6.3 Air Temperature Needed to Dissipate Plant Thermal Discharge

The results from the river thermal model shown above have shown that while most of the time the temperature at the head waters of Lake Pepin is slightly elevated due to the thermal discharge of the Prairie Island plant, there are occasions during which the air temperature is cold enough to dissipate all of plant thermal discharge in the river between Lock and Dam #3 and Lake Pepin. The required air temperature is calculated iteratively with Equations 1-3 using an nominal wind speed of 5 mph, a relative humidity of 50%, and a river temperature of 3 °C. The total surface area of the river between Lock and Dam #3 and Lake Pepin is 2.365 square miles determined from the areas of the individual branches shown in Table 2-1. The calculated air temperature required to dissipate all of the thermal energy discharged from the plant under these conditions is approximately -18 °C.

ε = 64.757 (cal/cm^2/day/°C)
η = 654.79 (cal/cm^2/day)
S = -849.061 (cal/cm^2/day) = -3.636 * 10^9 (BTU/hr/$mile^2$)
S * Area = -8.599 * 10^9 (BTU/hr)
Thermal Discharge = 36,750 °F * ft^3/s * 1 BTU/°F/lb * 62.4 lb/ ft^3 *3600 s/hr
= 8.256 * 10^9 (BTU/hr)

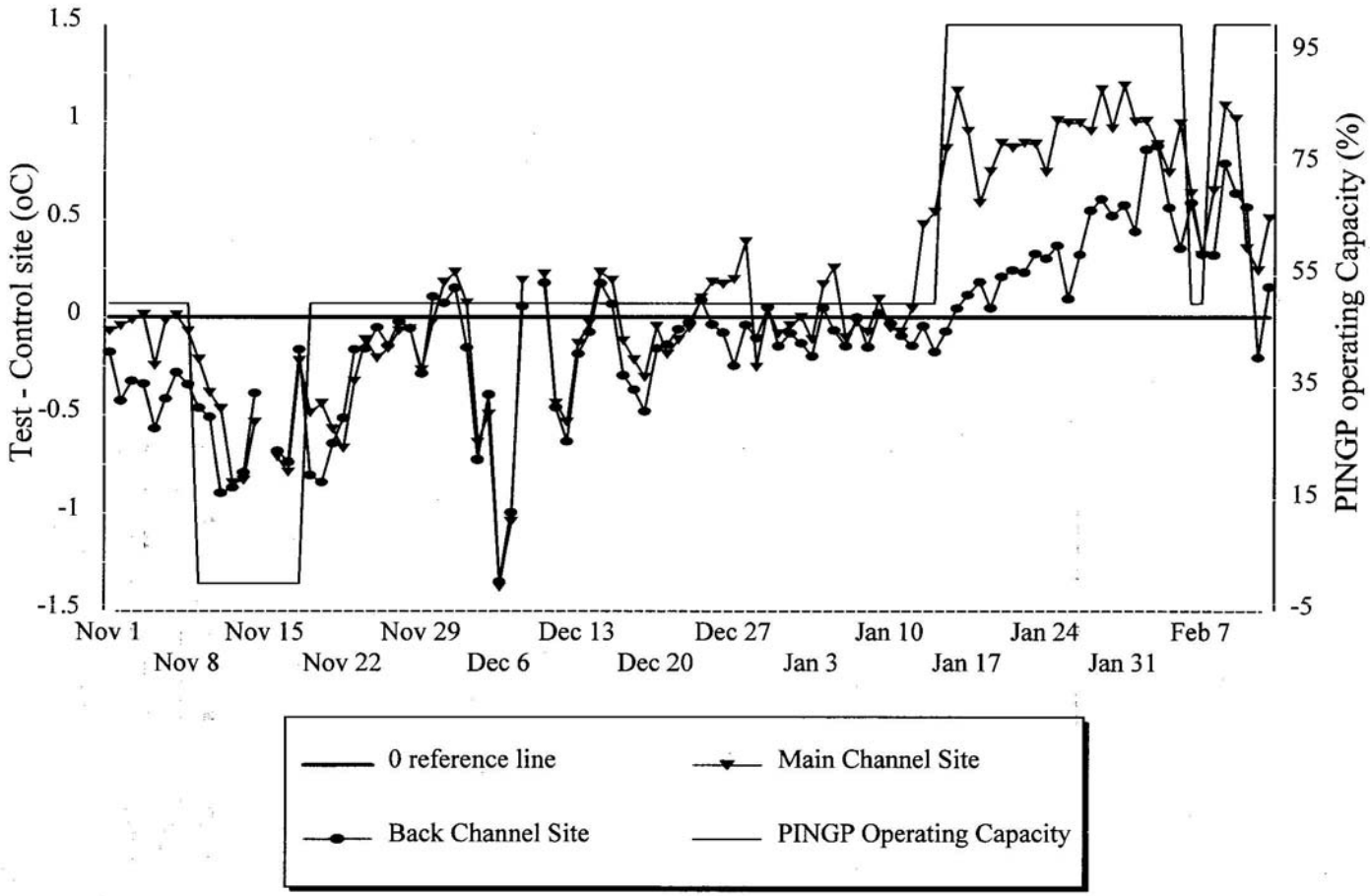

Figure 6-1 – Mississippi River Temperature Data from DNR report [4]

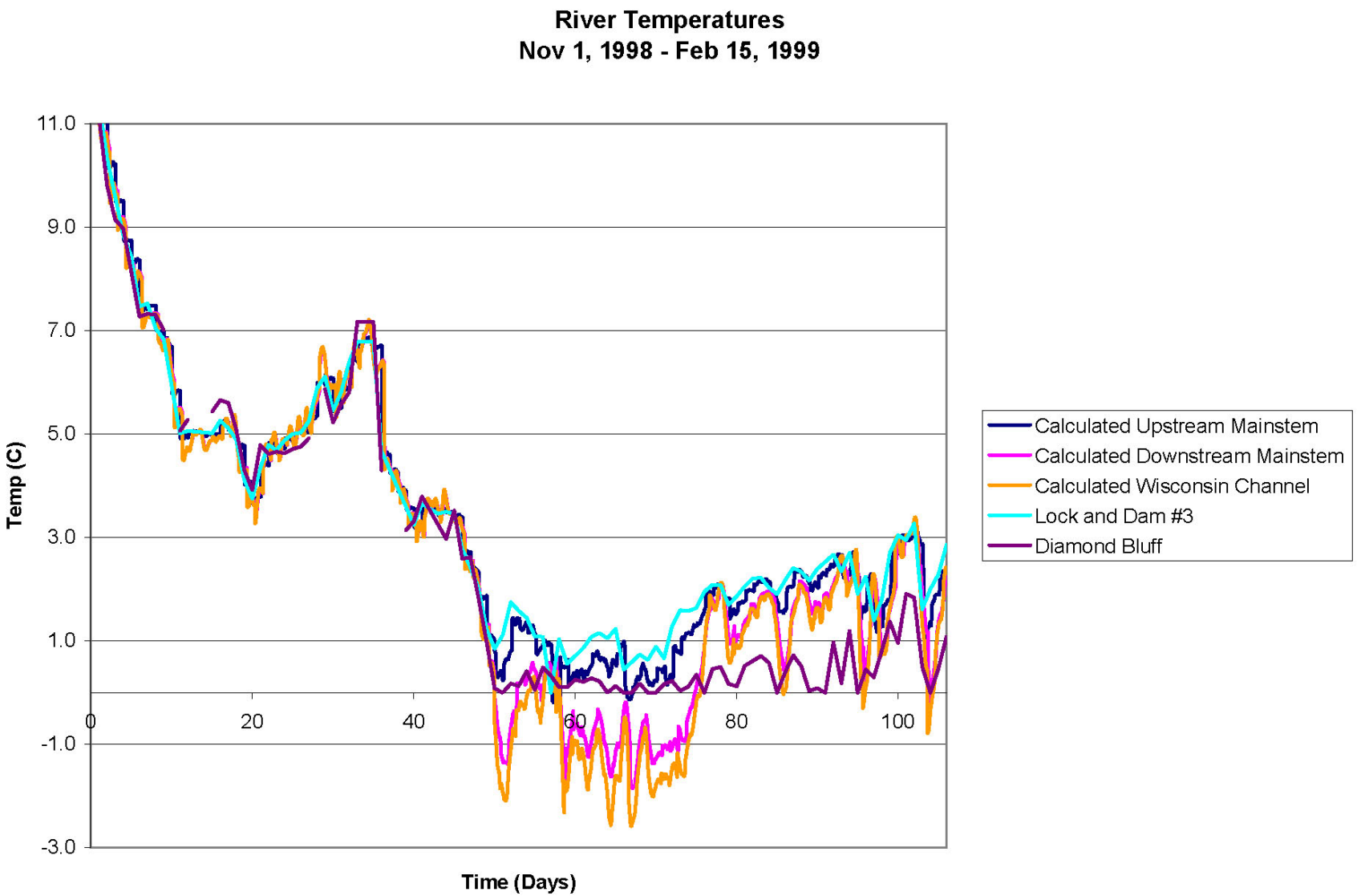

Figure 6-2 – Mississippi River Thermal Model Results Winter 1998/99

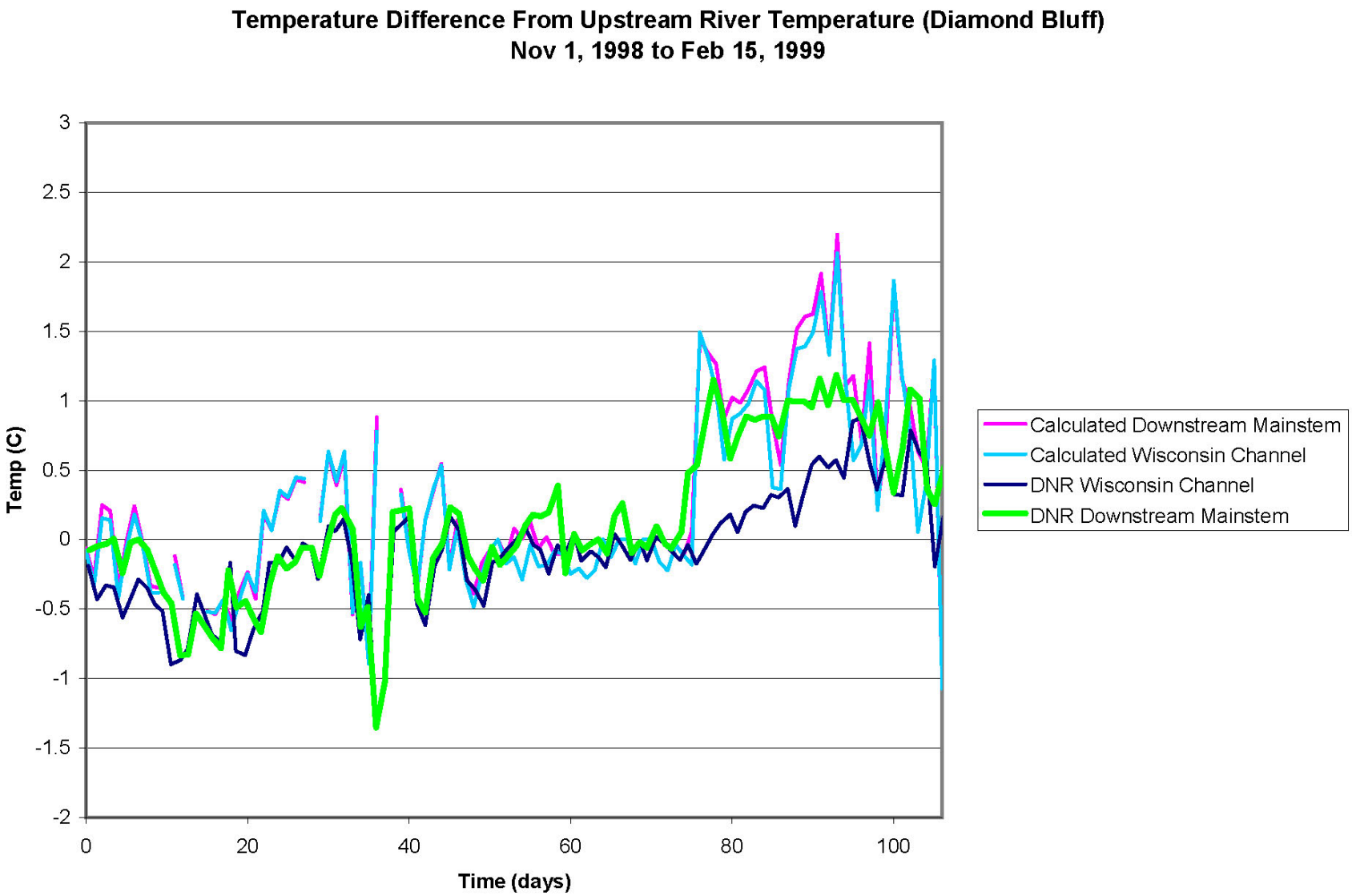

Figure 6-3 – Comparison of Thermal Model to DNR Data

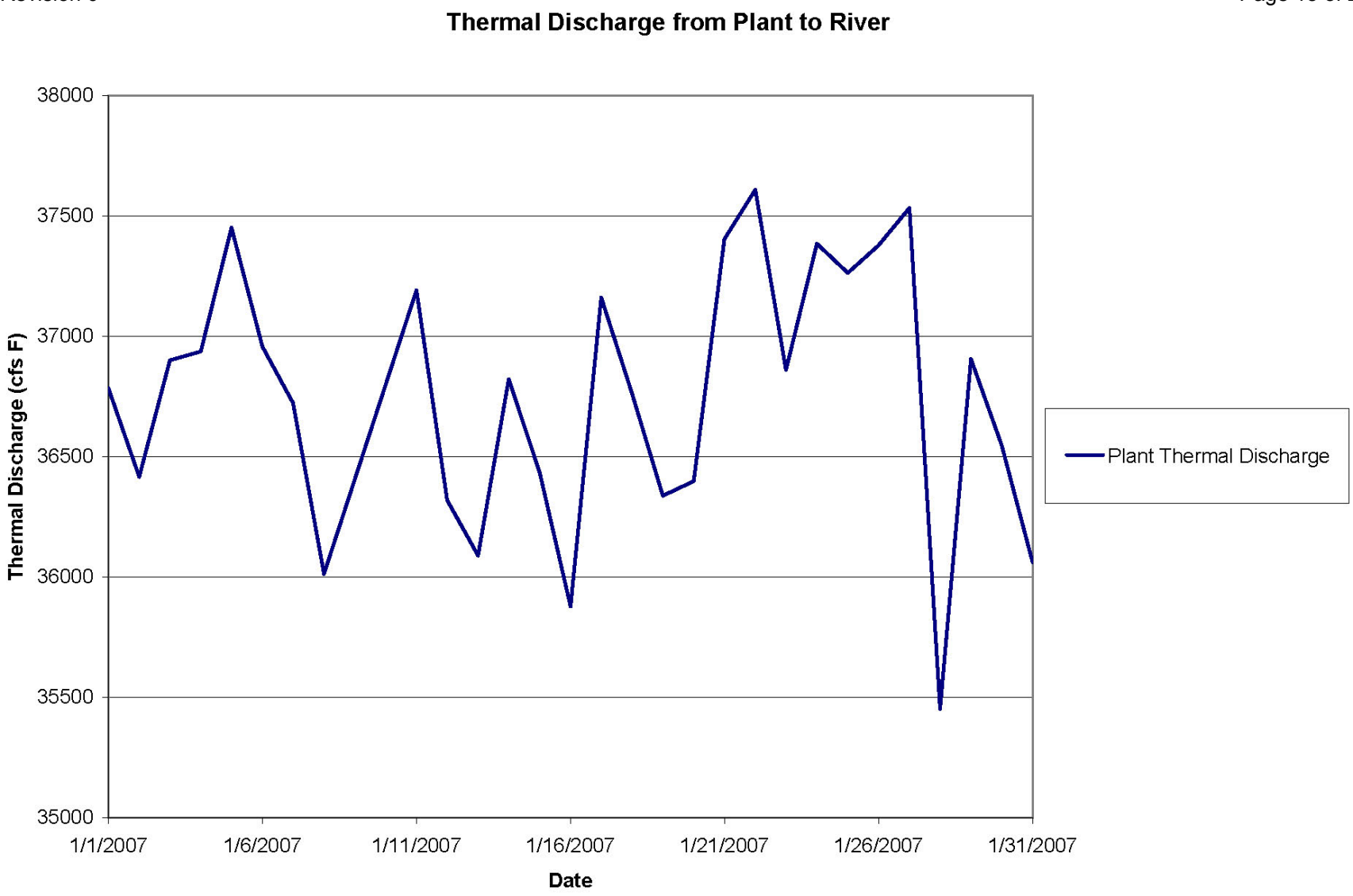

Figure 6-4 – Thermal Discharge of Plant to River, January 2007

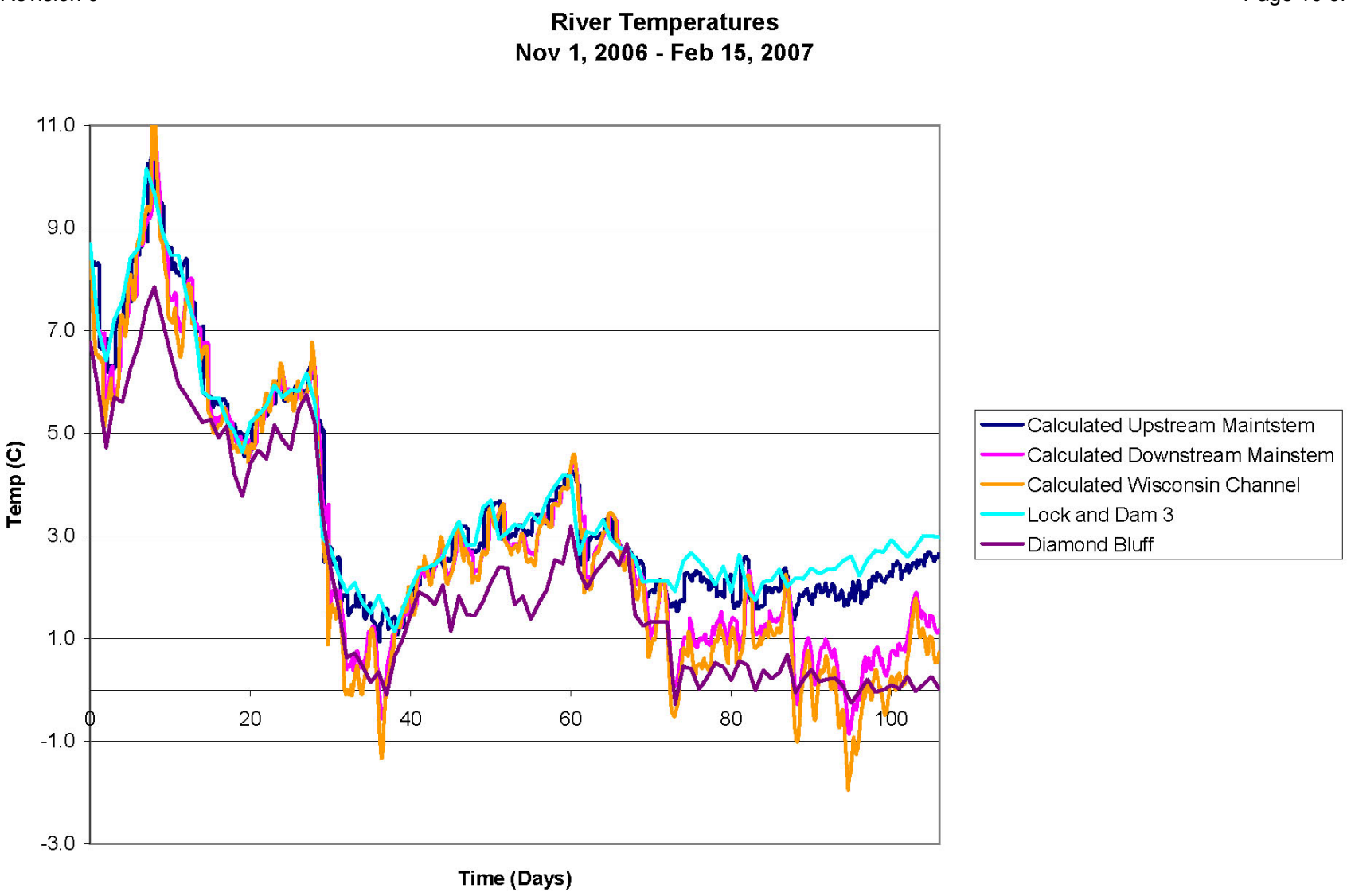

Figure 6-5 – River Temperatures During Winter of 2006/07 Without EPU

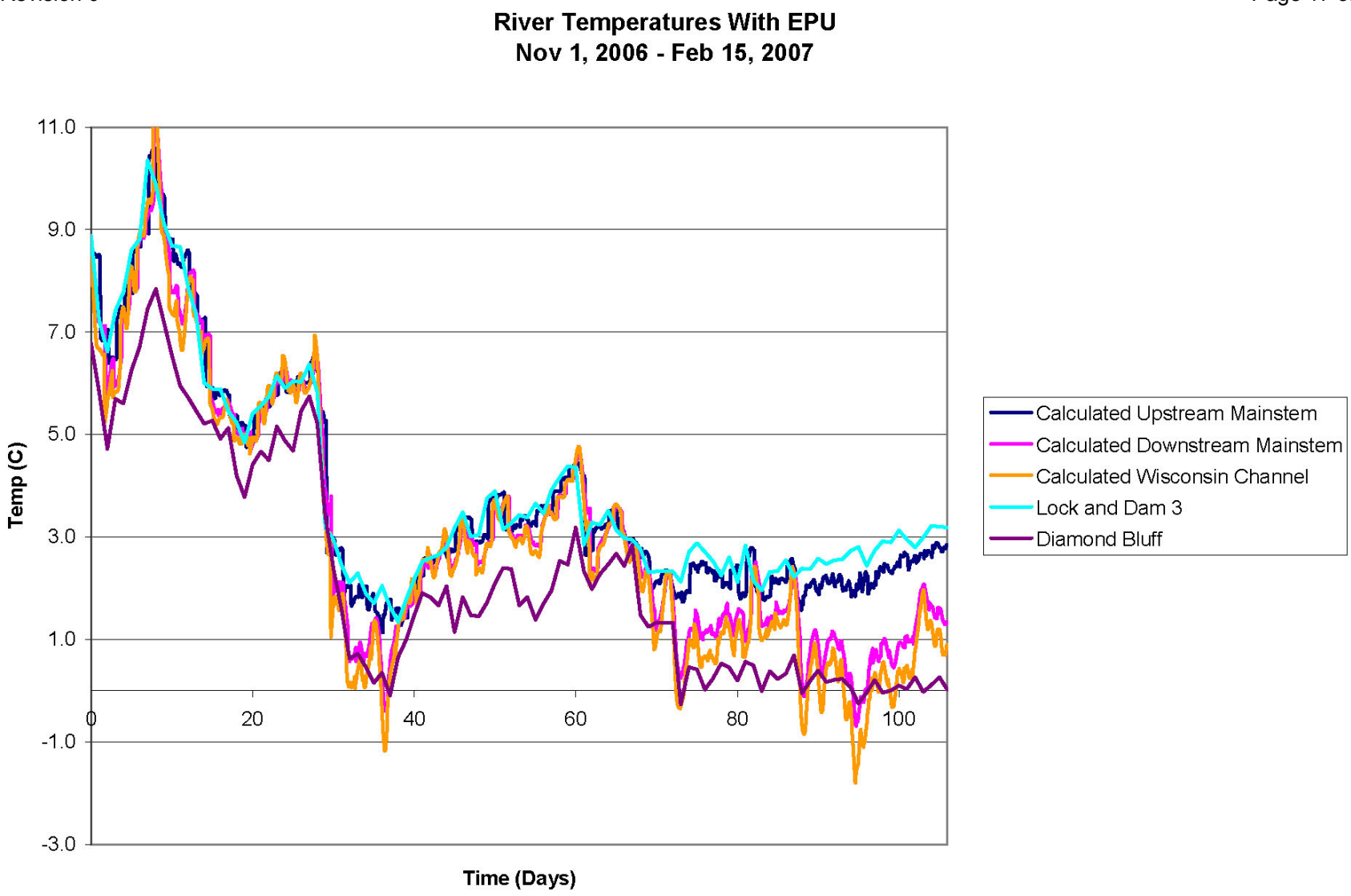

Figure 6-6 - River Temperatures During Winter of 2006/07 With EPU

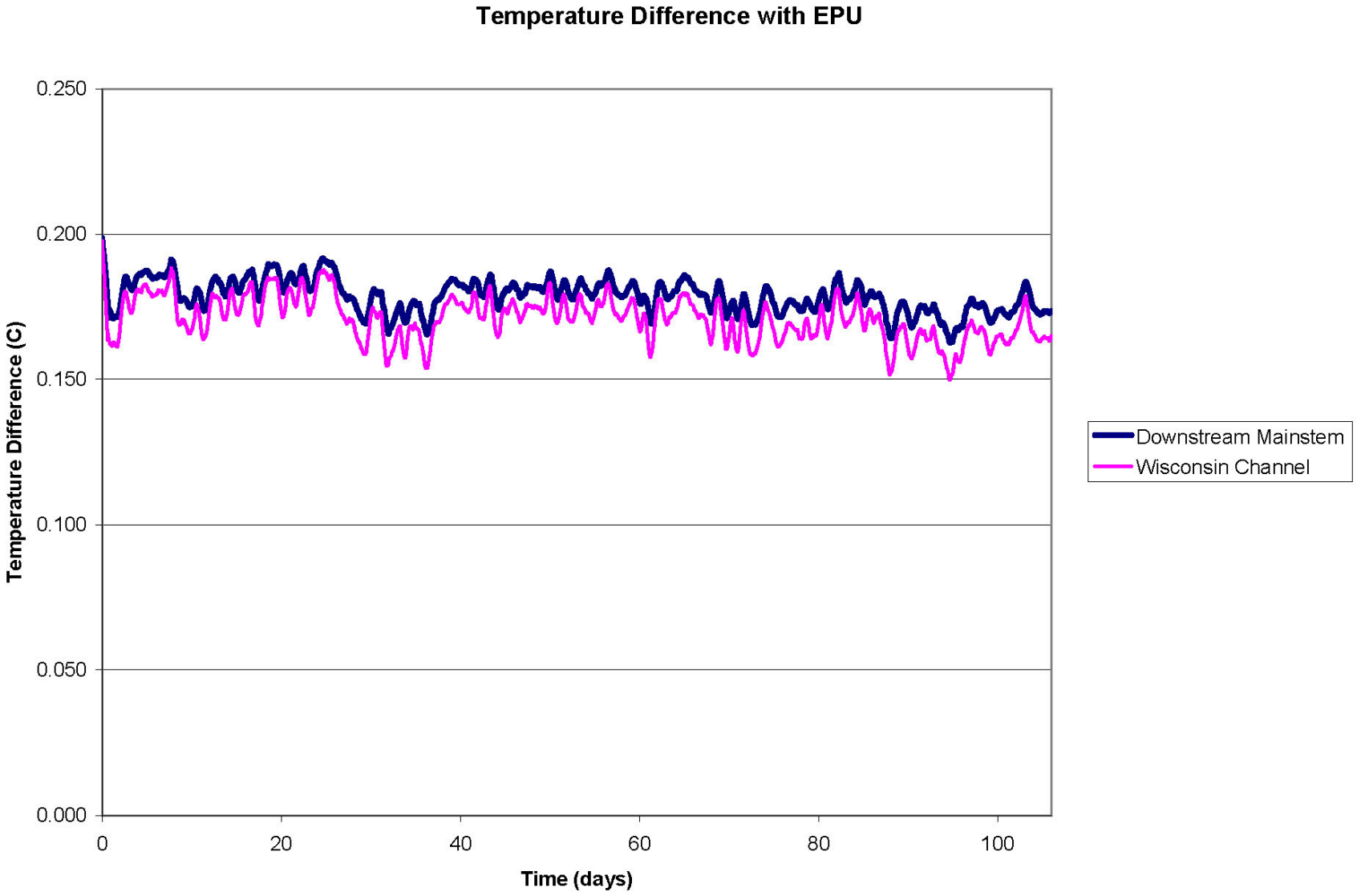

Figure 6-7 – Temperature Difference at the Head Waters of Lake Pepin Due to EPU

6.4 Ice Out Date and Maximum Ice Thickness Predictions for Lake Pepin

The correlations from Reference 4.3 are used to predict the ice out date and the maximum ice thickness for Lake Pepin when climatic, geographic, and bathymetric variables are considered. Since these correlations do not consider the impact of the Prairie Island Plant on the ice cover of Lake Pepin, they are used as a control representing what the ice out date and maximum ice thickness would naturally be without influence from the plant. These predictions are compared to historical data in Sections 6.5 and 6.6. If the correlations are able to accurately predict the ice out date and maximum ice thickness of Lake Pepin, it can be said that the effect of the Prairie Island plant is insignificant when compared to the natural climatic, geographic, and bathymetric variables.

Equations 7 through 13 are used to predict ice out dates and maximum ice thicknesses for the years for which this data is available. The mean air temperatures, FT2 and FT3, and the predictions are calculated for the subject years in Attachment E. The latitude, elevation, surface area, and mean depth of Lake Pepin are documented in Input 2.4. The snow depth data used in Equations 10 and 11 are taken from Reference 4.8 for the years 1982 through 1986 and Reference 4.12 for the years 1990 through 2008. It can be seen that the predictions of Equations 8 and 13 are the same for each year since they are not dependent on the average air temperature or snow depth variables.

Table 6-1: Predictions of Ice Out Date for Lake Pepin (Julian Day)

Year	FT2 (°C)	Equation 7	Equation 8	Equation 9
1990	8.20	92.23	99.86	90.21
1991	9.40	87.64	99.86	82.70
1992	8.19	92.27	99.86	90.28
1993	6.23	99.73	99.86	102.50
1994	7.67	94.24	99.86	93.51
1995	7.56	94.65	99.86	94.18
1996	5.59	102.17	99.86	106.49
1997	6.94	97.01	99.86	98.04
1998	9.64	86.72	99.86	81.20
1999	9.16	88.58	99.86	84.24
2000	9.52	87.19	99.86	81.97
2001	6.69	97.96	99.86	99.60
2002	7.40	95.27	99.86	95.19
2003	7.19	96.06	99.86	96.49
2004	7.96	93.14	99.86	91.70
2005	9.05	88.98	99.86	84.89
2006	9.24	88.27	99.86	83.74
2007	8.75	90.13	99.86	86.78
2008	6.06	100.36	99.86	103.52
Average	7.81	93.69	99.86	92.61

Table 6-2: Predictions of Maximum Ice Thickness for Lake Pepin (cm)

Year	FT3 (°C)	Snow Depth (cm)	Equation 10	Equation 11	Equation 12	Equation 13
1982	3.58	12.7	43.66	42.79	47.25	39.42
1983	5.44	25.4	42.22	43.17	45.96	39.42
1984	1.89	5.08	44.84	42.56	48.42	39.42
1985	4.82	Not Recorded	-	-	46.39	39.42
1986	3.81	7.62	43.69	42.64	47.09	39.42
1990	5.01	7	43.04	42.62	46.26	39.42
1991	5.73	9	42.57	42.68	45.76	39.42
1992	4.93	5	43.14	42.56	46.31	39.42
1993	3.91	11	43.53	42.74	47.02	39.42
1994	3.79	13	43.53	42.80	47.10	39.42
1995	5.80	1	42.78	42.44	45.71	39.42
1996	3.08	8	44.08	42.65	47.59	39.42
1997	3.59	4	43.93	42.53	47.24	39.42
1998	6.45	Not Recorded	-	-	45.26	39.42
1999	6.47	16	41.94	42.89	45.24	39.42
2000	6.63	11	42.00	42.74	45.13	39.42
2001	4.10	4	43.64	42.53	46.89	39.42
2002	6.31	8	42.27	42.65	45.35	39.42
2003	4.74	Not Recorded	-	-	46.45	39.42
2004	5.17	7	42.95	42.62	46.15	39.42
2005	6.29	0	42.53	42.41	45.37	39.42
2006	7.01	0	42.13	42.41	44.87	39.42
2007	6.04	20	42.05	43.01	45.54	39.42
2008	4.30	2	43.59	42.47	46.75	39.42
Average	4.95		43.05	42.66	46.30	39.42

6.5 Ice Out Date Data for Lake Pepin

Ice out date data for Lake Pepin is available from four sources. The first is Table D1 of Reference 4.5 in which the ice out date for Lake Pepin is given for 1992-96 and 1998. The second source is the Army Corps of Engineers website, [4.6], where the first day of spring barge traffic is recorded as the ice out date for the years 2000 through 2008. The third source is the Minnesota State Climatology Working Group website, [4.7] which has ice-out date for Lake Pepin for the years 1998-2008. The fourth source is a database of water quality data collected by the USGS between 1990 and 2008 which can be found in Attachment E, [4.12]. The ice out date in the USGS data from Reference 4.12 is said to be the first date in spring in which the majority of the observation points are ice free. This data is compared to the ice out date predictions from Equations 7, 8, and 9 in Table 6-3. The difference between the predicted ice out date and the recorded ice out date is defined as the predicted date minus the recorded date. If the difference is negative, then the ice cover on the lake broke up later than expected for that year. If the difference is positive, then the ice cover on the lake broke up earlier than expected for that year. The magnitude of the difference are compared to the standard errors of the equations to infer the significance of the impact of the Prairie Island plant on the ice out date in Section 7.0.

Table 6-3: Comparison of Recorded Ice Out Dates to Predictions

Year	Reference	Recorded Ice Out Day	Recorded Ice Out Julian Day	Difference from Equation 7 (days)	Difference from Equation 8 (days)	Difference from Equation 9 (days)
1990	4.12	20-Mar	79	13.23	20.86	11.21
1991	4.12	28-Mar	87	0.64	12.86	-4.3
1992	4.5	26-Mar	86	6.27	13.86	4.28
1992	4.12	16-Mar	76	16.27	23.86	14.28
1993	4.12	29-Mar	88	11.73	11.86	14.5
1994	4.5	31-Mar	90	4.24	9.86	3.51
1994	4.12	28-Mar	87	7.24	12.86	6.51
1995	4.5	26-Mar	85	9.65	14.86	9.18
1995	4.12	20-Mar	79	15.65	20.86	15.18
1996	4.5	9-Apr	100	2.17	-0.14	6.49
1996	4.12	9-Apr	100	2.17	-0.14	6.49
1997	4.12	16-Apr	106	-9.45	-6.14	-8.71
1998	4.5	25-Mar	84	2.72	15.86	-2.8
1998	4.7	25-Mar	84	2.72	15.86	-2.8
1998	4.12	4-Mar	63	23.72	36.86	18.2
1999	4.7	27-Mar	86	2.58	13.86	-1.76
1999	4.12	30-Mar	89	-0.42	10.86	-4.76
2000	4.6	2-Mar	62	25.19	37.86	19.97
2000	4.7	Feb-29	60	27.19	39.86	21.97
2000	4.12	7-Mar	67	20.19	32.86	14.97
2001	4.6	10-Apr	100	-2.04	-0.14	-0.4
2001	4.7	11-Apr	101	-3.04	-1.14	-1.4
2001	4.12	3-May	123	-25.04	-23.14	-23.4
2002	4.6	12-Mar	71	24.27	28.86	24.19
2002	4.7	25-Mar	84	11.27	15.86	11.19
2002	4.12	2-Apr	92	3.27	7.86	3.19
2003	4.6	27-Mar	86	10.06	13.86	10.49
2003	4.7	31-Mar	90	6.06	9.86	6.49
2004	4.6	19-Mar	79	14.14	20.86	12.7
2004	4.7	27-Mar	87	6.14	12.86	4.7
2004	4.12	8-Apr	99	-5.86	0.86	-7.3
2005	4.6	28-Mar	87	1.98	12.86	-2.11
2005	4.7	4-Apr	94	-5.02	5.86	-9.11
2005	4.12	6-Apr	96	-7.02	3.86	-11.11
2006	4.6	21-Mar	80	8.27	19.86	3.74
2006	4.7	1-Apr	91	-2.73	8.86	-7.26
2006	4.12	4-Apr	94	-5.73	5.86	-10.26
2007	4.6	29-Mar	88	2.13	11.86	-1.22
2007	4.7	24-Mar	83	7.13	16.86	3.78
2008	4.6	9-Apr	100	0.36	-0.14	3.52
2008	4.7	15-Apr	106	-5.64	-6.14	-2.48
2008	4.12	17-Apr	108	-7.64	-8.14	-4.48
		Average	88.02	4.99	11.84	3.47

6.6 Maximum Ice Thickness Data for Lake Pepin

Ice thickness data for Lake Pepin is available from three sources. The first is a collection of ice thickness measurements made by the Prairie Island plant from 1982 to 1986. These measurements are included as Attachment B, [4.8]. The second source is a collection of ice thickness data taken by the Army Corps of Engineers from 2000 to 2008 which can be found in Attachment C, [4.7]. The third source is a database of water quality data collected by the USGS between 1990 and 2008 which can be found in Attachment E, [4.12]. This data is compared to the predictions from Equations 10 through 13 in Table 6-4. The difference between the predicted maximum ice thickness and the recorded maximum ice thickness is defined as the predicted thickness minus the recorded thickness. If the difference is negative, then the ice cover on the lake was thicker than expected for that year. If the difference is positive, then the ice cover on the lake was thinner than expected for that year. The magnitude of the difference are compared to the standard errors of the equations to infer the significance of the impact of the Prairie Island plant on the ice thickness in Section 7.0.

Table 6-4: Comparison of Recorded Maximum Ice Thickness to Predictions

Year	Reference	Recorded Maximum Ice Thickness (cm)	Difference from Equation 10 (cm)	Difference from Equation 11 (cm)	Difference from Equation 12 (cm)	Difference from Equation 13 (cm)
1982	4.7	73.66	-30	-30.87	-26.41	-34.24
1983	4.7	50.8	-8.58	-7.63	-4.84	-11.38
1984	4.7	73.66	-28.82	-31.1	-25.24	-34.24
1985	4.7	68.58		-	-22.19	-29.16
1986	4.7	73.66	-29.97	-31.02	-26.57	-34.24
1990	4.12	66	-22.96	-23.38	-19.74	-26.58
1991	4.12	66	-23.43	-23.32	-20.24	-26.58
1992	4.12	54	-10.86	-11.44	-7.69	-14.58
1993	4.12	64	-20.47	-21.26	-16.98	-24.58
1994	4.12	55	-11.47	-12.2	-7.9	-15.58
1995	4.12	54	-11.22	-11.56	-8.29	-14.58
1996	4.12	76	-31.92	-33.35	-28.41	-36.58
1997	4.12	66	-22.07	-23.47	-18.76	-26.58
1998	4.12	37			8.26	2.42
1999	4.12	49	-7.06	-6.11	-3.76	-9.58
2000	4.8	45.72	-	-	-0.59	-6.3
2000	4.12	47	-5	-4.26	-1.87	-7.58
2001	4.8	66.04	-	-	-19.15	-26.62
2001	4.12	61	-17.36	-18.47	-14.11	-21.58
2002	4.8	33.02	-	-	12.33	6.4
2002	4.12	34	8.27	8.65	11.35	5.42
2003	4.8	66.04	-	-	-19.59	-26.62
2004	4.8	53.34	-	-	-7.19	-13.92
2004	4.12	57	-14.05	-14.38	-10.85	-17.58
2005	4.8	66.04	-	-	-20.67	-26.62
2005	4.12	54	-11.47	-11.59	-8.63	-14.58
2006	4.8	43.18	-	-	1.69	-3.76
2006	4.12	39	3.13	3.41	5.87	0.42
2007	4.8	50.8	-	-	-5.26	-11.38
2007	4.12	52	-9.95	-8.99	-6.46	-12.58
2008	4.8	81.28	-	-	-34.53	-41.86
2008	4.12	80	-36.41	-37.53	-33.25	-40.58
Average		60.42	-16.27	-16.66	-11.86	-18.61

7.0 Conclusions

The cold weather thermal model developed by Paily and used by Stefan to model heat loss from the Mississippi River between Lock and Dam #3 and the head waters of Lake Pepin has been recreated in Excel. By comparing the results of the thermal model to recorded temperature measurements, the thermal model has been found to be sufficiently accurate to be used for analyzing the heat loss from this section of river.

Using this model it was shown that the Prairie Island EPU can be expected to increase the average temperature of the river water at the entrance to Lake Pepin by less than 0.2 °C when the river flow rate is at the winter average of 10,000 ft^3/s. It has also been shown that if the air temperature is approximately 21 °C below the temperature of the water, the entire heat load discharged into the river from both units of Prairie Island can be dissipated from the surface of the water between Lock and Dam #3 and the head waters of Lake Pepin.

The recorded ice out dates for Lake Pepin mostly come before the dates predicted by the correlations developed in Reference 4.3. The average difference between the recorded and predicted ice out dates are within the standard errors associated with Equations 7 and 9 which are in part dependent on average air temperature. The difference is outside of the standard error associated with Equation 8 which is independent of average air temperature.

The recorded maximum ice thicknesses are almost always greater than the thicknesses predicted by the correlations developed in Reference 4.3. The difference between the recorded and predicted thicknesses are on average greater than the standard error for Equations 10, 11 and 13 and less than the standard error for Equation 12.

Overall, the following conclusions have been reached in this evaluation:

- While some of the thermal energy discharged by the Prairie Island plant is transferred into Lake Pepin, it appears that the ice cover on the lake is dominated by the average air temperature.

- The temperature of the water entering Lake Pepin varies greatly due to changes in air temperature and that the air temperature can be, and is occasionally, cold enough to dissipate all of plant discharge energy before it reaches Lake Pepin.

- The planned EPU at Prairie Island will raise the average water temperatures at the head waters of Lake by at most 0.2° C at a river flow rate of 10,000 ft^3/s.

- That correlations based on average air temperature, geographic, and bathymetric variables alone predict the ice out date for Lake Pepin four to six days later than the actual ice out date on average over the years 1992-2008. However, since this difference in ice out date is within the standard error of the correlations, it therefore does not demonstrate that Prairie Island has a significant effect on ice out date of Lake Pepin.

- That correlations based on average air temperature, geographic, and bathymetric variables alone under predict the maximum ice thickness recorded at Lake Pepin. The comparison of the recorded maximum ice thickness data with the predicted ice thicknesses implies that the thermal discharge from Prairie Island does not have a significant effect on the maximum ice thickness on Lake Pepin.

8.0 Attachments

Attachment A – River Thermal Model Spreadsheet and Macro A1-A9
Attachment B – Prairie Island Ice Thickness Data for Lake Pepin – Reference 4.8 B1-B72
Attachment C – Army Corps of Engineers Lake Pepin Ice Data – Reference 4.6 C1-C9
Attachment D – Minnesota State Climatology Working Group Ice Data – Reference 4.7 D1-D23
Attachment E – CD containing the following files:

Input 2.1 - NWS Meteorological Data.zip, 4017 KB, 1/26/2010, 10:17 AM
Input 2.2 – Lock Dam Temps.xls, 747 KB, 11/10/2009, 10:08 AM
Input 2.2 – River Outdoor Temps.xls, 665 KB, 11/10/2009, 11:16 AM
Inputs 2.2 and 2.5 – ERCS data.xls, 170 KB, 1/26/2010, 10:23 AM
Input 2.6 – LockDam3Flowrate.xls, 1531 KB, 11/4/2009, 11:01 AM
Section 6.1 – Paily Nov 1 1998 Dec 20 1998 20000cfs.xls, 2331 KB, 1/25/2010, 4:51 PM
Section 6.1 - Paily Dec 21 1998 Feb 15 1999 10000cfs.xls, 2169 KB, 1/25/2010, 4:39 PM
Section 6.2 - Paily Nov 2006 Feb 2007.xls, 2420 KB, 1/27/2010, 1:41 PM
Section 6.2 - Paily Nov 2006 Feb 2007 EPU.xls, 2903 KB, 1/26/2010, 8:31 AM
Section 6.4 - Ice Out Date.xls, 7306 KB, 5/25/2010, 2:23 PM
Section 6.5 – Maximum Ice Thickness.xls, 9765 KB, 5/25/2010, 1:03 PM
Reference 4.1 – Lake Pepin H Stefan report.pdf, 2570 KB, 9/11/2009, 9:45 AM
Reference 4.2 – DNR Investigational Report 481.pdf, 3633 KB, 9/18/2009, 9:07 AM
Reference 4.3 – Stefan ice cover climate Bathy.pdf, 765 KB, 11/2/2009, 4:42 PM
Reference 4.4 - Winter-Regime Thermal Response of Heated Streams.pdf, 730 KB, 10/2/2009, 2:20 PM
Reference 4.12 – USGS Lake Pepin Ice Data.xls, 1200 KB, 5/19/2010, 10:57 AM

Attachment F - Letter to Northern States Power from Minnesota Department of Natural Resources – Reference 4.11 F1-F2

Upstream Mainstem

Q	10000	ft^3/s	2.44658E+13 cm^3/day
h	11.7	ft	356.616 cm
Width	800	ft	24384 cm
L	3.04	mile	489240.576 cm
Velocity	2813538.462	cm/day	0.728438228 mile/hour
			4.2 hours

ρ	1	g/cm^3
c_p	1	cal/gram/°C
T_{air}	3.9	
RH	81.3	%
Wind	7.2	m/s
Upstream Temp	6.11	°C

Days 151

Downstream Mainstem

Q	6632.94056	ft^3/s	1.6228E+13 cm^3/day
h	11.7	ft	356.616 cm
Width	730	ft	22250.4 cm
L	8	mile	1287475.2 cm
Velocity	2045154.34	cm/day	0.5295 mile/hour
			15.1 hours

Wisconsin Channel

Q	3367.059	ft^3/s	8.23777E+12 cm^3/day
h	6.8	ft	207.264 cm
Width	620	ft	18897.6 cm
L	6.8	mile	1094353.92 cm
Velocity	2103192	cm/day	0.544526173 mile/hour
			12.5 hours

dx	$T_{stream-1}$	T_{stream}	η	ε	S	delta T
cm	°C	°C	$cal/cm^2/day$	$cal/cm^2/day/°C$	$cal/cm^2/day$	°C
11649	6.111	6.111	-238.526	46.924	-48.233	-0.0006
11649	6.111	6.110	-238.526	46.924	-48.206	-0.0006
11649	6.110	6.109	-238.526	46.924	-48.180	-0.0006
11649	6.109	6.109	-238.526	46.924	-48.153	-0.0006
11649	6.109	6.108	-238.526	46.924	-48.127	-0.0006
11649	6.108	6.108	-238.526	46.924	-48.100	-0.0006
11649	6.108	6.107	-238.526	46.924	-48.073	-0.0006
11649	6.107	6.107	-238.526	46.924	-48.047	-0.0006
11649	6.107	6.106	-238.526	46.924	-48.020	-0.0006
11649	6.106	6.105	-238.526	46.924	-47.994	-0.0006
11649	6.105	6.105	-238.526	46.924	-47.967	-0.0006
11649	6.105	6.104	-238.526	46.924	-47.941	-0.0006
11649	6.104	6.104	-238.526	46.924	-47.914	-0.0006
11649	6.104	6.103	-238.526	46.924	-47.888	-0.0006
11649	6.103	6.103	-238.526	46.924	-47.862	-0.0006
11649	6.103	6.102	-238.526	46.924	-47.835	-0.0006
11649	6.102	6.102	-238.526	46.924	-47.809	-0.0006
11649	6.102	6.101	-238.526	46.924	-47.782	-0.0006
11649	6.101	6.100	-238.526	46.924	-47.756	-0.0006
11649	6.100	6.100	-238.526	46.924	-47.730	-0.0006
11649	6.100	6.099	-238.526	46.924	-47.703	-0.0006
11649	6.100	6.099	-238.526	46.924	-47.693	-0.0006
11649	6.099	6.099	-238.526	46.924	-47.683	-0.0006
11649	6.099	6.099	-238.526	46.924	-47.673	-0.0006
11649	6.099	6.098	-238.526	46.924	-47.662	-0.0006
11649	6.099	6.098	-238.526	46.924	-47.652	-0.0006
11649	6.099	6.098	-238.526	46.924	-47.642	-0.0006
11649	6.098	6.098	-238.526	46.924	-47.632	-0.0006
11649	6.098	6.098	-238.526	46.924	-47.622	-0.0006
11649	6.098	6.097	-238.526	46.924	-47.612	-0.0006
11649	6.098	6.097	-238.526	46.924	-47.601	-0.0006
11649	6.098	6.097	-238.526	46.924	-47.597	-0.0006
11649	6.097	6.097	-238.526	46.924	-47.593	-0.0006
11649	6.097	6.097	-238.526	46.924	-47.589	-0.0006
11649	6.097	6.097	-238.526	46.924	-47.585	-0.0006
11649	6.097	6.097	-238.526	46.924	-47.581	-0.0006
11649	6.097	6.097	-238.526	46.924	-47.577	-0.0006
11649	6.097	6.097	-238.526	46.924	-47.573	-0.0006
11649	6.097	6.096	-238.526	46.924	-47.569	-0.0006
11649	6.097	6.096	-238.526	46.924	-47.565	-0.0006
11649	6.097	6.096	-238.526	46.924	-47.561	-0.0006
11649	6.097	6.097	-238.526	46.924	-47.589	-0.0006

dx	$T_{stream-1}$	T_{stream}	η	ε	S	delta T
cm	°C	°C	$cal/cm^2/day$	$cal/cm^2/day$	$cal/cm^2/day$	°C
8526	6.098	6.097	-238.526	46.924	-47.616	-0.0006
8526	6.099	6.098	-238.526	46.924	-47.643	-0.0006
8526	6.099	6.099	-238.526	46.924	-47.670	-0.0006
8526	6.100	6.099	-238.526	46.924	-47.697	-0.0006
8526	6.100	6.100	-238.526	46.924	-47.724	-0.0006
8526	6.101	6.100	-238.526	46.924	-47.752	-0.0006
8526	6.101	6.101	-238.526	46.924	-47.779	-0.0006
8526	6.102	6.101	-238.526	46.924	-47.806	-0.0006
8526	6.103	6.102	-238.526	46.924	-47.833	-0.0006
8526	6.103	6.103	-238.526	46.924	-47.859	-0.0006
8526	6.104	6.103	-238.526	46.924	-47.885	-0.0006
8526	6.104	6.104	-238.526	46.924	-47.910	-0.0006
8526	6.105	6.104	-238.526	46.924	-47.936	-0.0006
8526	6.105	6.105	-238.526	46.924	-47.962	-0.0006
8526	6.106	6.105	-238.526	46.924	-47.988	-0.0006
8526	6.106	6.106	-238.526	46.924	-48.013	-0.0006
8526	6.107	6.106	-238.526	46.924	-48.039	-0.0006
8526	6.108	6.107	-238.526	46.924	-48.065	-0.0006
8526	6.108	6.108	-238.526	46.924	-48.090	-0.0006
8526	6.109	6.109	-238.526	46.924	-48.145	-0.0006
8526	6.110	6.110	-238.526	46.924	-48.199	-0.0006
8526	6.112	6.111	-238.526	46.924	-48.253	-0.0006
8526	6.113	6.112	-238.526	46.924	-48.308	-0.0006
8526	6.114	6.113	-238.526	46.924	-48.362	-0.0006
8526	6.115	6.114	-238.526	46.924	-48.416	-0.0006
8526	6.116	6.116	-238.526	46.924	-48.470	-0.0006
8526	6.117	6.117	-238.526	46.924	-48.524	-0.0006
8526	6.118	6.118	-238.526	46.924	-48.578	-0.0006
8526	6.120	6.119	-238.526	46.924	-48.632	-0.0006
8526	6.121	6.120	-238.526	46.924	-48.699	-0.0006
8526	6.122	6.122	-238.526	46.924	-48.767	-0.0006
8526	6.124	6.123	-238.526	46.924	-48.834	-0.0006
8526	6.125	6.125	-238.526	46.924	-48.901	-0.0006
8526	6.127	6.126	-238.526	46.924	-48.968	-0.0006
8526	6.128	6.128	-238.526	46.924	-49.035	-0.0006
8526	6.130	6.129	-238.526	46.924	-49.102	-0.0006
8526	6.131	6.130	-238.526	46.924	-49.169	-0.0006
8526	6.132	6.132	-238.526	46.924	-49.236	-0.0006
8526	6.134	6.133	-238.526	46.924	-49.303	-0.0006
8526	6.136	6.135	-238.526	46.924	-49.398	-0.0006
8526	6.138	6.137	-238.526	46.924	-49.494	-0.0006
8526	6.140	6.139	-238.526	46.924	-49.589	-0.0006
8526	6.142	6.141	-238.526	46.924	-49.684	-0.0006
8526	6.144	6.143	-238.526	46.924	-49.779	-0.0006
8526	6.146	6.146	-238.526	46.924	-49.875	-0.0006
8526	6.148	6.148	-238.526	46.924	-49.970	-0.0006
8526	6.150	6.150	-238.526	46.924	-50.065	-0.0006
8526	6.152	6.152	-238.526	46.924	-50.160	-0.0006
8526	6.154	6.154	-238.526	46.924	-50.254	-0.0006
8526	6.157	6.157	-238.526	46.924	-50.408	-0.0006
8526	6.161	6.160	-238.526	46.924	-50.561	-0.0006
8526	6.164	6.163	-238.526	46.924	-50.714	-0.0006
8526	6.167	6.167	-238.526	46.924	-50.868	-0.0006
8526	6.171	6.170	-238.526	46.924	-51.021	-0.0006
8526	6.174	6.173	-238.526	46.924	-51.174	-0.0006
8526	6.177	6.176	-238.526	46.924	-51.327	-0.0006
8526	6.180	6.180	-238.526	46.924	-51.480	-0.0006
8526	6.184	6.183	-238.526	46.924	-51.633	-0.0006
8526	6.187	6.186	-238.526	46.924	-51.786	-0.0006
8526	6.190	6.189	-238.526	46.924	-51.912	-0.0006
8526	6.192	6.192	-238.526	46.924	-52.037	-0.0006
8526	6.195	6.194	-238.526	46.924	-52.163	-0.0006
8526	6.198	6.197	-238.526	46.924	-52.289	-0.0006
8526	6.200	6.200	-238.526	46.924	-52.414	-0.0006
8526	6.203	6.202	-238.526	46.924	-52.540	-0.0006
8526	6.206	6.205	-238.526	46.924	-52.666	-0.0006
8526	6.208	6.208	-238.526	46.924	-52.791	-0.0006
8526	6.211	6.210	-238.526	46.924	-52.916	-0.0006
8526	6.214	6.213	-238.526	46.924	-53.042	-0.0006
8526	6.216	6.215	-238.526	46.924	-53.158	-0.0006

dx	$T_{stream-1}$	T_{stream}	η	ε	S	delta T
cm	°C	°C	$cal/cm^2/day$	$cal/cm^2/day$	$cal/cm^2/day$	°C
8755	6.098	6.097	-238.526	46.924	-47.616	-0.0010
8755	6.098	6.097	-238.526	46.924	-47.624	-0.0010
8755	6.098	6.097	-238.526	46.924	-47.633	-0.0010
8755	6.098	6.098	-238.526	46.924	-47.641	-0.0010
8755	6.099	6.098	-238.526	46.924	-47.649	-0.0010
8755	6.099	6.098	-238.526	46.924	-47.658	-0.0010
8755	6.099	6.098	-238.526	46.924	-47.666	-0.0010
8755	6.099	6.098	-238.526	46.924	-47.674	-0.0010
8755	6.099	6.098	-238.526	46.924	-47.683	-0.0010
8755	6.100	6.099	-238.526	46.924	-47.689	-0.0010
8755	6.100	6.099	-238.526	46.924	-47.696	-0.0010
8755	6.100	6.099	-238.526	46.924	-47.703	-0.0010
8755	6.100	6.099	-238.526	46.924	-47.710	-0.0010
8755	6.100	6.099	-238.526	46.924	-47.717	-0.0010
8755	6.100	6.099	-238.526	46.924	-47.723	-0.0010
8755	6.100	6.099	-238.526	46.924	-47.730	-0.0010
8755	6.101	6.100	-238.526	46.924	-47.737	-0.0010
8755	6.101	6.100	-238.526	46.924	-47.744	-0.0010
8755	6.101	6.100	-238.526	46.924	-47.750	-0.0010
8755	6.102	6.101	-238.526	46.924	-47.785	-0.0010
8755	6.102	6.101	-238.526	46.924	-47.821	-0.0010
8755	6.103	6.102	-238.526	46.924	-47.867	-0.0010
8755	6.104	6.103	-238.526	46.924	-47.913	-0.0010
8755	6.105	6.104	-238.526	46.924	-47.959	-0.0010
8755	6.106	6.105	-238.526	46.924	-48.006	-0.0010
8755	6.107	6.106	-238.526	46.924	-48.052	-0.0010
8755	6.108	6.107	-238.526	46.924	-48.098	-0.0010
8755	6.109	6.108	-238.526	46.924	-48.144	-0.0010
8755	6.110	6.109	-238.526	46.924	-48.189	-0.0010
8755	6.111	6.110	-238.526	46.924	-48.248	-0.0010
8755	6.113	6.112	-238.526	46.924	-48.307	-0.0010
8755	6.114	6.113	-238.526	46.924	-48.370	-0.0010
8755	6.115	6.114	-238.526	46.924	-48.433	-0.0010
8755	6.117	6.116	-238.526	46.924	-48.496	-0.0010
8755	6.118	6.117	-238.526	46.924	-48.558	-0.0010
8755	6.119	6.118	-238.526	46.924	-48.621	-0.0010
8755	6.121	6.120	-238.526	46.924	-48.683	-0.0010
8755	6.122	6.121	-238.526	46.924	-48.745	-0.0010
8755	6.123	6.122	-238.526	46.924	-48.808	-0.0010
8755	6.125	6.124	-238.526	46.924	-48.898	-0.0010
8755	6.127	6.126	-238.526	46.924	-48.988	-0.0010
8755	6.130	6.129	-238.526	46.924	-49.100	-0.0010
8755	6.132	6.131	-238.526	46.924	-49.212	-0.0010
8755	6.134	6.133	-238.526	46.924	-49.324	-0.0010
8755	6.137	6.136	-238.526	46.924	-49.435	-0.0010
8755	6.139	6.138	-238.526	46.924	-49.547	-0.0010
8755	6.141	6.140	-238.526	46.924	-49.658	-0.0010
8755	6.144	6.143	-238.526	46.924	-49.769	-0.0010
8755	6.146	6.145	-238.526	46.924	-49.880	-0.0010
8755	6.150	6.149	-238.526	46.924	-50.049	-0.0010
8755	6.153	6.152	-238.526	46.924	-50.217	-0.0010
8755	6.157	6.156	-238.526	46.924	-50.384	-0.0010
8755	6.160	6.159	-238.526	46.924	-50.550	-0.0010
8755	6.164	6.163	-238.526	46.924	-50.717	-0.0010
8755	6.168	6.167	-238.526	46.924	-50.883	-0.0010
8755	6.171	6.170	-238.526	46.924	-51.049	-0.0010
8755	6.175	6.174	-238.526	46.924	-51.215	-0.0010
8755	6.178	6.177	-238.526	46.924	-51.381	-0.0010
8755	6.182	6.181	-238.526	46.924	-51.546	-0.0010
8755	6.185	6.184	-238.526	46.924	-51.686	-0.0010
8755	6.188	6.187	-238.526	46.924	-51.825	-0.0010
8755	6.191	6.190	-238.526	46.924	-51.983	-0.0010
8755	6.194	6.193	-238.526	46.924	-52.142	-0.0010
8755	6.198	6.197	-238.526	46.924	-52.300	-0.0011
8755	6.201	6.200	-238.526	46.924	-52.458	-0.0011
8755	6.205	6.203	-238.526	46.924	-52.616	-0.0011
8755	6.208	6.207	-238.526	46.924	-52.774	-0.0011
8755	6.211	6.210	-238.526	46.924	-52.932	-0.0011
8755	6.215	6.214	-238.526	46.924	-53.089	-0.0011
8755	6.218	6.217	-238.526	46.924	-53.238	-0.0011

8526	6.219	6.218	-238.526	46.924	-53.274	-0.0006
8526	6.221	6.220	-238.526	46.924	-53.390	-0.0006
8526	6.223	6.223	-238.526	46.924	-53.506	-0.0006
8526	6.226	6.225	-238.526	46.924	-53.622	-0.0006
8526	6.228	6.228	-238.526	46.924	-53.737	-0.0006
8526	6.231	6.230	-238.526	46.924	-53.853	-0.0006
8526	6.233	6.233	-238.526	46.924	-53.969	-0.0006
8526	6.236	6.235	-238.526	46.924	-54.084	-0.0006
8526	6.238	6.238	-238.526	46.924	-54.200	-0.0006
8526	6.240	6.239	-238.526	46.924	-54.280	-0.0006
8526	6.242	6.241	-238.526	46.924	-54.360	-0.0006
8526	6.243	6.243	-238.526	46.924	-54.440	-0.0006
8526	6.245	6.244	-238.526	46.924	-54.520	-0.0006
8526	6.247	6.246	-238.526	46.924	-54.600	-0.0006
8526	6.249	6.248	-238.526	46.924	-54.680	-0.0006
8526	6.250	6.250	-238.526	46.924	-54.760	-0.0006
8526	6.252	6.251	-238.526	46.924	-54.840	-0.0006
8526	6.254	6.253	-238.526	46.924	-54.920	-0.0006
8526	6.255	6.255	-238.526	46.924	-55.000	-0.0006
8526	6.257	6.256	-238.526	46.924	-55.082	-0.0006
8526	6.259	6.258	-238.526	46.924	-55.165	-0.0006
8526	6.261	6.260	-238.526	46.924	-55.247	-0.0006
8526	6.262	6.262	-238.526	46.924	-55.329	-0.0006
8526	6.264	6.263	-238.526	46.924	-55.411	-0.0006
8526	6.266	6.265	-238.526	46.924	-55.493	-0.0006
8526	6.268	6.267	-238.526	46.924	-55.575	-0.0006
8526	6.269	6.269	-238.526	46.924	-55.657	-0.0007
8526	6.271	6.270	-238.526	46.924	-55.740	-0.0007
8526	6.273	6.272	-238.526	46.924	-55.822	-0.0007
8526	6.274	6.273	-238.526	46.924	-55.881	-0.0007
8526	6.275	6.275	-238.526	46.924	-55.940	-0.0007
8526	6.277	6.276	-238.526	46.924	-56.000	-0.0007
8526	6.278	6.277	-238.526	46.924	-56.059	-0.0007
8526	6.279	6.279	-238.526	46.924	-56.119	-0.0007
8526	6.280	6.280	-238.526	46.924	-56.178	-0.0007
8526	6.282	6.281	-238.526	46.924	-56.238	-0.0007
8526	6.283	6.282	-238.526	46.924	-56.297	-0.0007
8526	6.284	6.284	-238.526	46.924	-56.357	-0.0007
8526	6.286	6.285	-238.526	46.924	-56.416	-0.0007
8526	6.287	6.286	-238.526	46.924	-56.486	-0.0007
8526	6.288	6.288	-238.526	46.924	-56.556	-0.0007
8526	6.290	6.289	-238.526	46.924	-56.625	-0.0007
8526	6.291	6.291	-238.526	46.924	-56.695	-0.0007
8526	6.293	6.292	-238.526	46.924	-56.765	-0.0007
8526	6.294	6.294	-238.526	46.924	-56.834	-0.0007
8526	6.296	6.295	-238.526	46.924	-56.904	-0.0007
8526	6.297	6.297	-238.526	46.924	-56.974	-0.0007
8526	6.299	6.298	-238.526	46.924	-57.043	-0.0007
8526	6.300	6.300	-238.526	46.924	-57.113	-0.0007
8526	6.302	6.301	-238.526	46.924	-57.178	-0.0007
8526	6.303	6.302	-238.526	46.924	-57.242	-0.0007
8526	6.304	6.304	-238.526	46.924	-57.308	-0.0007
8526	6.306	6.305	-238.526	46.924	-57.373	-0.0007
8526	6.307	6.307	-238.526	46.924	-57.438	-0.0007
8526	6.309	6.308	-238.526	46.924	-57.503	-0.0007
8526	6.310	6.309	-238.526	46.924	-57.568	-0.0007
8526	6.311	6.311	-238.526	46.924	-57.633	-0.0007
8526	6.313	6.312	-238.526	46.924	-57.698	-0.0007
8526	6.314	6.314	-238.526	46.924	-57.763	-0.0007
8526	6.316	6.316	-238.526	46.924	-57.862	-0.0007
8526	6.318	6.318	-238.526	46.924	-57.961	-0.0007
8526	6.321	6.320	-238.526	46.924	-58.060	-0.0007
8526	6.323	6.322	-238.526	46.924	-58.159	-0.0007
8526	6.325	6.324	-238.526	46.924	-58.258	-0.0007
8526	6.327	6.326	-238.526	46.924	-58.357	-0.0007
8526	6.329	6.328	-238.526	46.924	-58.456	-0.0007
8526	6.331	6.330	-238.526	46.924	-58.555	-0.0007
8526	6.333	6.333	-238.526	46.924	-58.654	-0.0007
8526	6.335	6.335	-238.526	46.924	-58.753	-0.0007
8526	6.338	6.337	-238.526	46.924	-58.874	-0.0007
8526	6.340	6.340	-238.526	46.924	-58.995	-0.0007
8526	6.343	6.342	-238.526	46.924	-59.117	-0.0007
8526	6.346	6.345	-238.526	46.924	-59.238	-0.0007
8526	6.348	6.348	-238.526	46.924	-59.359	-0.0007
8526	6.351	6.350	-238.526	46.924	-59.481	-0.0007
8526	6.353	6.353	-238.526	46.924	-59.602	-0.0007
8526	6.356	6.355	-238.526	46.924	-59.723	-0.0007
8526	6.359	6.358	-238.526	46.924	-59.844	-0.0007
8526	6.361	6.360	-238.526	46.924	-59.965	-0.0007
8526	6.364	6.363	-238.526	46.924	-60.087	-0.0007
8526	6.366	6.366	-238.526	46.924	-60.208	-0.0007

8755	6.221	6.220	-238.526	46.924	-53.386	-0.0011
8755	6.224	6.223	-238.526	46.924	-53.543	-0.0011
8755	6.228	6.227	-238.526	46.924	-53.700	-0.0011
8755	6.231	6.230	-238.526	46.924	-53.857	-0.0011
8755	6.234	6.233	-238.526	46.924	-54.014	-0.0011
8755	6.238	6.237	-238.526	46.924	-54.170	-0.0011
8755	6.241	6.240	-238.526	46.924	-54.326	-0.0011
8755	6.244	6.243	-238.526	46.924	-54.483	-0.0011
8755	6.248	6.247	-238.526	46.924	-54.639	-0.0011
8755	6.250	6.249	-238.526	46.924	-54.760	-0.0011
8755	6.253	6.252	-238.526	46.924	-54.882	-0.0011
8755	6.256	6.255	-238.526	46.924	-55.023	-0.0011
8755	6.259	6.258	-238.526	46.924	-55.164	-0.0011
8755	6.262	6.261	-238.526	46.924	-55.305	-0.0011
8755	6.265	6.264	-238.526	46.924	-55.446	-0.0011
8755	6.268	6.267	-238.526	46.924	-55.587	-0.0011
8755	6.271	6.270	-238.526	46.924	-55.728	-0.0011
8755	6.274	6.273	-238.526	46.924	-55.868	-0.0011
8755	6.277	6.276	-238.526	46.924	-56.008	-0.0011
8755	6.280	6.279	-238.526	46.924	-56.151	-0.0011
8755	6.283	6.282	-238.526	46.924	-56.294	-0.0011
8755	6.287	6.286	-238.526	46.924	-56.478	-0.0011
8755	6.291	6.290	-238.526	46.924	-56.661	-0.0011
8755	6.295	6.293	-238.526	46.924	-56.844	-0.0011
8755	6.299	6.297	-238.526	46.924	-57.027	-0.0011
8755	6.302	6.301	-238.526	46.924	-57.210	-0.0011
8755	6.306	6.305	-238.526	46.924	-57.393	-0.0012
8755	6.310	6.309	-238.526	46.924	-57.576	-0.0012
8755	6.314	6.313	-238.526	46.924	-57.759	-0.0012
8755	6.318	6.316	-238.526	46.924	-57.920	-0.0012
8755	6.321	6.320	-238.526	46.924	-58.081	-0.0012
8755	6.324	6.323	-238.526	46.924	-58.223	-0.0012
8755	6.327	6.326	-238.526	46.924	-58.366	-0.0012
8755	6.330	6.329	-238.526	46.924	-58.508	-0.0012
8755	6.333	6.332	-238.526	46.924	-58.651	-0.0012
8755	6.336	6.335	-238.526	46.924	-58.793	-0.0012
8755	6.339	6.338	-238.526	46.924	-58.935	-0.0012
8755	6.342	6.341	-238.526	46.924	-59.077	-0.0012
8755	6.345	6.344	-238.526	46.924	-59.219	-0.0012
8755	6.348	6.347	-238.526	46.924	-59.371	-0.0012
8755	6.352	6.351	-238.526	46.924	-59.523	-0.0012
8755	6.355	6.354	-238.526	46.924	-59.669	-0.0012
8755	6.358	6.357	-238.526	46.924	-59.814	-0.0012
8755	6.361	6.360	-238.526	46.924	-59.959	-0.0012
8755	6.364	6.363	-238.526	46.924	-60.104	-0.0012
8755	6.367	6.366	-238.526	46.924	-60.249	-0.0012
8755	6.370	6.369	-238.526	46.924	-60.394	-0.0012
8755	6.373	6.372	-238.526	46.924	-60.539	-0.0012
8755	6.376	6.375	-238.526	46.924	-60.684	-0.0012
8755	6.379	6.378	-238.526	46.924	-60.824	-0.0012
8755	6.382	6.381	-238.526	46.924	-60.965	-0.0012
8755	6.385	6.384	-238.526	46.924	-61.081	-0.0012
8755	6.387	6.386	-238.526	46.924	-61.197	-0.0012
8755	6.390	6.389	-238.526	46.924	-61.314	-0.0012
8755	6.392	6.391	-238.526	46.924	-61.430	-0.0012

	A	B	C	D	E	F	G
1	Upstream Mainstem						
2							
3	Q	10000	ft^3/s	=B3*(2.54*12)^3*24*3600	cm^3/day		
4	h	11.7	ft	=B4*2.54*12	cm		
5	Width	800	ft	=B5*12*2.54	cm		
6	L	3.04	mile	=B6*2.54*12*5280	cm		
7	Velocity	=D$3/(D$4*D$5)	cm/day	=B7/24/160934.4	mile/hour		
8				=B6/D7	hours		
9							
10	ρ	1	g/cm^3				
11	c_p	1	cal/gram/°C				
12	T_{air}	3.9					
13	RH	81.3490174703154	%				
14	Wind	7.2	m/s				
15	Upstream Temp	6.11111111111111	°C		Days	151	
16							
17	dx	$T_{stream-1}$	T_{stream}	η	ε	S	delta T
18	cm	°C	°C	$cal/cm^2/day$	$cal/cm^2/day/°C$	$cal/cm^2/day$	°C
19	=D$6/42	=B15	=B19+G19	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E19*B19+D19)	=F19/B$10/B$11/D$4/B$7*A19
20	=D$6/42	6.11054377457146	=B20+G20	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E20*B20+D20)	=F20/B$10/B$11/D$4/B$7*A20
21	=D$6/42	6.10997675116852	=B21+G21	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E21*B21+D21)	=F21/B$10/B$11/D$4/B$7*A21
22	=D$6/42	6.10941004072946	=B22+G22	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E22*B22+D22)	=F22/B$10/B$11/D$4/B$7*A22
23	=D$6/42	6.10884364308153	=B23+G23	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E23*B23+D23)	=F23/B$10/B$11/D$4/B$7*A23
24	=D$6/42	6.10827755805209	=B24+G24	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E24*B24+D24)	=F24/B$10/B$11/D$4/B$7*A24
25	=D$6/42	6.1077117854686	=B25+G25	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E25*B25+D25)	=F25/B$10/B$11/D$4/B$7*A25
26	=D$6/42	6.10714632515861	=B26+G26	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E26*B26+D26)	=F26/B$10/B$11/D$4/B$7*A26
27	=D$6/42	6.10658117694975	=B27+G27	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E27*B27+D27)	=F27/B$10/B$11/D$4/B$7*A27
28	=D$6/42	6.10601634066977	=B28+G28	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E28*B28+D28)	=F28/B$10/B$11/D$4/B$7*A28
29	=D$6/42	6.1054518161465	=B29+G29	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E29*B29+D29)	=F29/B$10/B$11/D$4/B$7*A29
30	=D$6/42	6.10488760320787	=B30+G30	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E30*B30+D30)	=F30/B$10/B$11/D$4/B$7*A30
31	=D$6/42	6.1043237016819	=B31+G31	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E31*B31+D31)	=F31/B$10/B$11/D$4/B$7*A31
32	=D$6/42	6.1037601113967	=B32+G32	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E32*B32+D32)	=F32/B$10/B$11/D$4/B$7*A32
33	=D$6/42	6.10319683218051	=B33+G33	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E33*B33+D33)	=F33/B$10/B$11/D$4/B$7*A33
34	=D$6/42	6.10263386386161	=B34+G34	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E34*B34+D34)	=F34/B$10/B$11/D$4/B$7*A34
35	=D$6/42	6.10207120626842	=B35+G35	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E35*B35+D35)	=F35/B$10/B$11/D$4/B$7*A35
36	=D$6/42	6.10150885922943	=B36+G36	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E36*B36+D36)	=F36/B$10/B$11/D$4/B$7*A36
37	=D$6/42	6.10094682257323	=B37+G37	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E37*B37+D37)	=F37/B$10/B$11/D$4/B$7*A37
38	=D$6/42	6.10038509612851	=B38+G38	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E38*B38+D38)	=F38/B$10/B$11/D$4/B$7*A38
39	=D$6/42	6.09982367972406	=B39+G39	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E39*B39+D39)	=F39/B$10/B$11/D$4/B$7*A39
40	=D$6/42	6.09960585060526	=B40+G40	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E40*B40+D40)	=F40/B$10/B$11/D$4/B$7*A40
41	=D$6/42	6.09938814738948	=B41+G41	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E41*B41+D41)	=F41/B$10/B$11/D$4/B$7*A41
42	=D$6/42	6.09917057000392	=B42+G42	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E42*B42+D42)	=F42/B$10/B$11/D$4/B$7*A42
43	=D$6/42	6.09895311837587	=B43+G43	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E43*B43+D43)	=F43/B$10/B$11/D$4/B$7*A43
44	=D$6/42	6.09873579243264	=B44+G44	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E44*B44+D44)	=F44/B$10/B$11/D$4/B$7*A44
45	=D$6/42	6.09851859210158	=B45+G45	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E45*B45+D45)	=F45/B$10/B$11/D$4/B$7*A45
46	=D$6/42	6.0983015173101	=B46+G46	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E46*B46+D46)	=F46/B$10/B$11/D$4/B$7*A46
47	=D$6/42	6.09808456798562	=B47+G47	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E47*B47+D47)	=F47/B$10/B$11/D$4/B$7*A47
48	=D$6/42	6.09786774405563	=B48+G48	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E48*B48+D48)	=F48/B$10/B$11/D$4/B$7*A48
49	=D$6/42	6.09765104544766	=B49+G49	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E49*B49+D49)	=F49/B$10/B$11/D$4/B$7*A49
50	=D$6/42	6.09756567579948	=B50+G50	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E50*B50+D50)	=F50/B$10/B$11/D$4/B$7*A50
51	=D$6/42	6.09748036422568	=B51+G51	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E51*B51+D51)	=F51/B$10/B$11/D$4/B$7*A51
52	=D$6/42	6.09739511068677	=B52+G52	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E52*B52+D52)	=F52/B$10/B$11/D$4/B$7*A52
53	=D$6/42	6.09730991514327	=B53+G53	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E53*B53+D53)	=F53/B$10/B$11/D$4/B$7*A53
54	=D$6/42	6.09722477755572	=B54+G54	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E54*B54+D54)	=F54/B$10/B$11/D$4/B$7*A54
55	=D$6/42	6.09713969788469	=B55+G55	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E55*B55+D55)	=F55/B$10/B$11/D$4/B$7*A55
56	=D$6/42	6.09705467609079	=B56+G56	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E56*B56+D56)	=F56/B$10/B$11/D$4/B$7*A56
57	=D$6/42	6.09696971213466	=B57+G57	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E57*B57+D57)	=F57/B$10/B$11/D$4/B$7*A57
58	=D$6/42	6.09688480597693	=B58+G58	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E58*B58+D58)	=F58/B$10/B$11/D$4/B$7*A58
59	=D$6/42	6.09679995757829	=B59+G59	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E59*B59+D59)	=F59/B$10/B$11/D$4/B$7*A59
60	=D$6/42	6.09737752017903	=B60+G60	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(E60*B60+D60)	=F60/B$10/B$11/D$4/B$7*A60
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	H	I	J	K	L	M	N	O
1		Downstream Mainstem						
2								
3		Q	=0.0000041*B4^2+0.5437*B3+1195.94	ft^3/s	=J3*(2.54*12)^3*24*3600	cm^3/day		
4		h	11.7	ft	=J4*2.54*12	cm		
5		Width	730	ft	=J5*12*2.54	cm		
6		L	8	mile	=J6*2.54*12*5280	cm		
7		Velocity	=L$3/(L$4*L$5)	cm/day	=J7/24/160934.4	mile/hour		
8					=J6/L7	hours		
9								
10								
11								
12								
13								
14								
15								
16								
17		dx	$T_{stream-1}$	T_{stream}	η	ε	S	delta T
18		cm	°C	°C	$cal/cm^2/day$	$cal/cm^2/day/°C$	$cal/cm^2/day$	°C
19		=L$6/151	6.09795477918083	=J19+O19	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M19*J19+L19)	=N19/B$10/B$11/L$4/J$7*I19
20		=L$6/151	6.09853516056091	=J20+O20	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M20*J20+L20)	=N20/B$10/B$11/L$4/J$7*I20
21		=L$6/151	6.09911524256413	=J21+O21	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M21*J21+L21)	=N21/B$10/B$11/L$4/J$7*I21
22		=L$6/151	6.09969502534685	=J22+O22	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M22*J22+L22)	=N22/B$10/B$11/L$4/J$7*I22
23		=L$6/151	6.10027450906535	=J23+O23	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M23*J23+L23)	=N23/B$10/B$11/L$4/J$7*I23
24		=L$6/151	6.10085369387586	=J24+O24	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M24*J24+L24)	=N24/B$10/B$11/L$4/J$7*I24
25		=L$6/151	6.1014325799345	=J25+O25	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M25*J25+L25)	=N25/B$10/B$11/L$4/J$7*I25
26		=L$6/151	6.10201116739731	=J26+O26	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M26*J26+L26)	=N26/B$10/B$11/L$4/J$7*I26
27		=L$6/151	6.10258945642025	=J27+O27	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M27*J27+L27)	=N27/B$10/B$11/L$4/J$7*I27
28		=L$6/151	6.10313879795547	=J28+O28	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M28*J28+L28)	=N28/B$10/B$11/L$4/J$7*I28
29		=L$6/151	6.10368782560035	=J29+O29	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M29*J29+L29)	=N29/B$10/B$11/L$4/J$7*I29
30		=L$6/151	6.10423653954588	=J30+O30	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M30*J30+L30)	=N30/B$10/B$11/L$4/J$7*I30
31		=L$6/151	6.10478493996408	=J31+O31	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M31*J31+L31)	=N31/B$10/B$11/L$4/J$7*I31
32		=L$6/151	6.10533302703945	=J32+O32	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M32*J32+L32)	=N32/B$10/B$11/L$4/J$7*I32
33		=L$6/151	6.10588080095323	=J33+O33	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M33*J33+L33)	=N33/B$10/B$11/L$4/J$7*I33
34		=L$6/151	6.10642826188655	=J34+O34	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M34*J34+L34)	=N34/B$10/B$11/L$4/J$7*I34
35		=L$6/151	6.10697541002048	=J35+O35	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M35*J35+L35)	=N35/B$10/B$11/L$4/J$7*I35
36		=L$6/151	6.10752224553591	=J36+O36	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M36*J36+L36)	=N36/B$10/B$11/L$4/J$7*I36
37		=L$6/151	6.1080687686137	=J37+O37	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M37*J37+L37)	=N37/B$10/B$11/L$4/J$7*I37
38		=L$6/151	6.10922853913677	=J38+O38	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M38*J38+L38)	=N38/B$10/B$11/L$4/J$7*I38
39		=L$6/151	6.11038759533012	=J39+O39	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M39*J39+L39)	=N39/B$10/B$11/L$4/J$7*I39
40		=L$6/151	6.1115438408508	=J40+O40	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M40*J40+L40)	=N40/B$10/B$11/L$4/J$7*I40
41		=L$6/151	6.11269937328985	=J41+O41	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M41*J41+L41)	=N41/B$10/B$11/L$4/J$7*I41
42		=L$6/151	6.11385419309011	=J42+O42	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M42*J42+L42)	=N42/B$10/B$11/L$4/J$7*I42
43		=L$6/151	6.11500830069413	=J43+O43	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M43*J43+L43)	=N43/B$10/B$11/L$4/J$7*I43
44		=L$6/151	6.11616169654422	=J44+O44	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M44*J44+L44)	=N44/B$10/B$11/L$4/J$7*I44
45		=L$6/151	6.11731438108236	=J45+O45	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M45*J45+L45)	=N45/B$10/B$11/L$4/J$7*I45
46		=L$6/151	6.1184663547503	=J46+O46	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M46*J46+L46)	=N46/B$10/B$11/L$4/J$7*I46
47		=L$6/151	6.1196176179895	=J47+O47	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M47*J47+L47)	=N47/B$10/B$11/L$4/J$7*I47
48		=L$6/151	6.12105101367321	=J48+O48	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M48*J48+L48)	=N48/B$10/B$11/L$4/J$7*I48
49		=L$6/151	6.12248355603391	=J49+O49	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M49*J49+L49)	=N49/B$10/B$11/L$4/J$7*I49
50		=L$6/151	6.12391445983547	=J50+O50	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M50*J50+L50)	=N50/B$10/B$11/L$4/J$7*I50
51		=L$6/151	6.12534451312319	=J51+O51	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M51*J51+L51)	=N51/B$10/B$11/L$4/J$7*I51
52		=L$6/151	6.12677371640637	=J52+O52	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M52*J52+L52)	=N52/B$10/B$11/L$4/J$7*I52
53		=L$6/151	6.12820207019404	=J53+O53	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M53*J53+L53)	=N53/B$10/B$11/L$4/J$7*I53
54		=L$6/151	6.12962957499492	=J54+O54	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M54*J54+L54)	=N54/B$10/B$11/L$4/J$7*I54
55		=L$6/151	6.13105623131739	=J55+O55	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M55*J55+L55)	=N55/B$10/B$11/L$4/J$7*I55
56		=L$6/151	6.13248203966959	=J56+O56	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M56*J56+L56)	=N56/B$10/B$11/L$4/J$7*I56
57		=L$6/151	6.13390700055928	=J57+O57	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M57*J57+L57)	=N57/B$10/B$11/L$4/J$7*I57
58		=L$6/151	6.1359440141633	=J58+O58	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M58*J58+L58)	=N58/B$10/B$11/L$4/J$7*I58
59		=L$6/151	6.13797983654839	=J59+O59	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M59*J59+L59)	=N59/B$10/B$11/L$4/J$7*I59
60		=L$6/151	6.14001037794569	=J60+O60	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M60*J60+L60)	=N60/B$10/B$11/L$4/J$7*I60
61		=L$6/151	6.14203972566835	=J61+O61	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M61*J61+L61)	=N61/B$10/B$11/L$4/J$7*I61
62		=L$6/151	6.14406788042074	=J62+O62	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M62*J62+L62)	=N62/B$10/B$11/L$4/J$7*I62
63		=L$6/151	6.14609484290683	=J63+O63	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M63*J63+L63)	=N63/B$10/B$11/L$4/J$7*I63
64		=L$6/151	6.14812061383018	=J64+O64	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M64*J64+L64)	=N64/B$10/B$11/L$4/J$7*I64
65		=L$6/151	6.15014519389393	=J65+O65	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M65*J65+L65)	=N65/B$10/B$11/L$4/J$7*I65
66		=L$6/151	6.1521685838008	=J66+O66	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M66*J66+L66)	=N66/B$10/B$11/L$4/J$7*I66
67		=L$6/151	6.1541907842531	=J67+O67	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M67*J67+L67)	=N67/B$10/B$11/L$4/J$7*I67
68		=L$6/151	6.15745892314022	=J68+O68	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M68*J68+L68)	=N68/B$10/B$11/L$4/J$7*I68
69		=L$6/151	6.16072585852409	=J69+O69	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M69*J69+L69)	=N69/B$10/B$11/L$4/J$7*I69
70		=L$6/151	6.16399178688671	=J70+O70	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M70*J70+L70)	=N70/B$10/B$11/L$4/J$7*I70
71		=L$6/151	6.16725651488142	=J71+O71	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M71*J71+L71)	=N71/B$10/B$11/L$4/J$7*I71
72		=L$6/151	6.17052004295327	=J72+O72	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M72*J72+L72)	=N72/B$10/B$11/L$4/J$7*I72
73		=L$6/151	6.17378237154717	=J73+O73	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M73*J73+L73)	=N73/B$10/B$11/L$4/J$7*I73
74		=L$6/151	6.17704350110786	=J74+O74	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M74*J74+L74)	=N74/B$10/B$11/L$4/J$7*I74
75		=L$6/151	6.18030343207992	=J75+O75	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M75*J75+L75)	=N75/B$10/B$11/L$4/J$7*I75
76		=L$6/151	6.18356216490773	=J76+O76	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M76*J76+L76)	=N76/B$10/B$11/L$4/J$7*I76
77		=L$6/151	6.18681970003555	=J77+O77	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M77*J77+L77)	=N77/B$10/B$11/L$4/J$7*I77
78		=L$6/151	6.18950445690591	=J78+O78	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M78*J78+L78)	=N78/B$10/B$11/L$4/J$7*I78
79		=L$6/151	6.19218823977631	=J79+O79	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M79*J79+L79)	=N79/B$10/B$11/L$4/J$7*I79
80		=L$6/151	6.19486731991808	=J80+O80	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M80*J80+L80)	=N80/B$10/B$11/L$4/J$7*I80
81		=L$6/151	6.19754542816237	=J81+O81	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M81*J81+L81)	=N81/B$10/B$11/L$4/J$7*I81
82		=L$6/151	6.20022256486462	=J82+O82	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M82*J82+L82)	=N82/B$10/B$11/L$4/J$7*I82
83		=L$6/151	6.20289873038008	=J83+O83	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M83*J83+L83)	=N83/B$10/B$11/L$4/J$7*I83
84		=L$6/151	6.20557392506396	=J84+O84	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M84*J84+L84)	=N84/B$10/B$11/L$4/J$7*I84
85		=L$6/151	6.20824814927128	=J85+O85	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M85*J85+L85)	=N85/B$10/B$11/L$4/J$7*I85
86		=L$6/151	6.21092140335694	=J86+O86	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M86*J86+L86)	=N86/B$10/B$11/L$4/J$7*I86
87		=L$6/151	6.2135936876757	=J87+O87	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M87*J87+L87)	=N87/B$10/B$11/L$4/J$7*I87
88		=L$6/151	6.21606755244852	=J88+O88	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M88*J88+L88)	=N88/B$10/B$11/L$4/J$7*I88
89		=L$6/151	6.2185404738431	=J89+O89	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M89*J89+L89)	=N89/B$10/B$11/L$4/J$7*I89
90		=L$6/151	6.22101070955361	=J90+O90	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M90*J90+L90)	=N90/B$10/B$11/L$4/J$7*I90
91		=L$6/151	6.22348000195157	=J91+O91	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M91*J91+L91)	=N91/B$10/B$11/L$4/J$7*I91
92		=L$6/151	6.22594835139948	=J92+O92	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M92*J92+L92)	=N92/B$10/B$11/L$4/J$7*I92
93		=L$6/151	6.22841575825967	=J93+O93	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M93*J93+L93)	=N93/B$10/B$11/L$4/J$7*I93

	H	I	J	K	L	M	N	O
94		=L$6/151	6.230882222289437	=J94+O94	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M94*J94+L94)	=N94/B$10/B$11/L$4/J$7*I94
95		=L$6/151	6.23334774566567	=J95+O95	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M95*J95+L95)	=N95/B$10/B$11/L$4/J$7*I95
96		=L$6/151	6.23581232693547	=J96+O96	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M96*J96+L96)	=N96/B$10/B$11/L$4/J$7*I96
97		=L$6/151	6.23827596706558	=J97+O97	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M97*J97+L97)	=N97/B$10/B$11/L$4/J$7*I97
98		=L$6/151	6.23998545530255	=J98+O98	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M98*J98+L98)	=N98/B$10/B$11/L$4/J$7*I98
99		=L$6/151	6.24169431971148	=J99+O99	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M99*J99+L99)	=N99/B$10/B$11/L$4/J$7*I99
100		=L$6/151	6.2433988066092	=J100+O100	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M100*J100+L100)	=N100/B$10/B$11/L$4/J$7*I100
101		=L$6/151	6.24510266992039	=J101+O101	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M101*J101+L101)	=N101/B$10/B$11/L$4/J$7*I101
102		=L$6/151	6.24680590987383	=J102+O102	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M102*J102+L102)	=N102/B$10/B$11/L$4/J$7*I102
103		=L$6/151	6.24850852669822	=J103+O103	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M103*J103+L103)	=N103/B$10/B$11/L$4/J$7*I103
104		=L$6/151	6.25021052062219	=J104+O104	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M104*J104+L104)	=N104/B$10/B$11/L$4/J$7*I104
105		=L$6/151	6.25191189187428	=J105+O105	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M105*J105+L105)	=N105/B$10/B$11/L$4/J$7*I105
106		=L$6/151	6.25361264068292	=J106+O106	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M106*J106+L106)	=N106/B$10/B$11/L$4/J$7*I106
107		=L$6/151	6.25531276727652	=J107+O107	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M107*J107+L107)	=N107/B$10/B$11/L$4/J$7*I107
108		=L$6/151	6.2570727993395	=J108+O108	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M108*J108+L108)	=N108/B$10/B$11/L$4/J$7*I108
109		=L$6/151	6.2588324136164	=J109+O109	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M109*J109+L109)	=N109/B$10/B$11/L$4/J$7*I109
110		=L$6/151	6.26058384619787	=J110+O110	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M110*J110+L110)	=N110/B$10/B$11/L$4/J$7*I110
111		=L$6/151	6.26233485644823	=J111+O111	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M111*J111+L111)	=N111/B$10/B$11/L$4/J$7*I111
112		=L$6/151	6.26408544446915	=J112+O112	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M112*J112+L112)	=N112/B$10/B$11/L$4/J$7*I112
113		=L$6/151	6.26583561036225	=J113+O113	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M113*J113+L113)	=N113/B$10/B$11/L$4/J$7*I113
114		=L$6/151	6.26758535422912	=J114+O114	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M114*J114+L114)	=N114/B$10/B$11/L$4/J$7*I114
115		=L$6/151	6.26933467617137	=J115+O115	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M115*J115+L115)	=N115/B$10/B$11/L$4/J$7*I115
116		=L$6/151	6.27108357629055	=J116+O116	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M116*J116+L116)	=N116/B$10/B$11/L$4/J$7*I116
117		=L$6/151	6.27283205468819	=J117+O117	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M117*J117+L117)	=N117/B$10/B$11/L$4/J$7*I117
118		=L$6/151	6.27409836214827	=J118+O118	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M118*J118+L118)	=N118/B$10/B$11/L$4/J$7*I118
119		=L$6/151	6.27536424949285	=J119+O119	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M119*J119+L119)	=N119/B$10/B$11/L$4/J$7*I119
120		=L$6/151	6.27663320835191	=J120+O120	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M120*J120+L120)	=N120/B$10/B$11/L$4/J$7*I120
121		=L$6/151	6.27790174730464	=J121+O121	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M121*J121+L121)	=N121/B$10/B$11/L$4/J$7*I121
122		=L$6/151	6.27916986648917	=J122+O122	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M122*J122+L122)	=N122/B$10/B$11/L$4/J$7*I122
123		=L$6/151	6.28043756604359	=J123+O123	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M123*J123+L123)	=N123/B$10/B$11/L$4/J$7*I123
124		=L$6/151	6.28170484610592	=J124+O124	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M124*J124+L124)	=N124/B$10/B$11/L$4/J$7*I124
125		=L$6/151	6.28297170681415	=J125+O125	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M125*J125+L125)	=N125/B$10/B$11/L$4/J$7*I125
126		=L$6/151	6.28423814830623	=J126+O126	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M126*J126+L126)	=N126/B$10/B$11/L$4/J$7*I126
127		=L$6/151	6.28550417072007	=J127+O127	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M127*J127+L127)	=N127/B$10/B$11/L$4/J$7*I127
128		=L$6/151	6.2869898744955	=J128+O128	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M128*J128+L128)	=N128/B$10/B$11/L$4/J$7*I128
129		=L$6/151	6.28847499063056	=J129+O129	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M129*J129+L129)	=N129/B$10/B$11/L$4/J$7*I129
130		=L$6/151	6.2899607347462	=J130+O130	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M130*J130+L130)	=N130/B$10/B$11/L$4/J$7*I130
131		=L$6/151	6.29144589202338	=J131+O131	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M131*J131+L131)	=N131/B$10/B$11/L$4/J$7*I131
132		=L$6/151	6.29293046269294	=J132+O132	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M132*J132+L132)	=N132/B$10/B$11/L$4/J$7*I132
133		=L$6/151	6.29441444698563	=J133+O133	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M133*J133+L133)	=N133/B$10/B$11/L$4/J$7*I133
134		=L$6/151	6.29589784513213	=J134+O134	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M134*J134+L134)	=N134/B$10/B$11/L$4/J$7*I134
135		=L$6/151	6.297380657363	=J135+O135	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M135*J135+L135)	=N135/B$10/B$11/L$4/J$7*I135
136		=L$6/151	6.29886288390873	=J136+O136	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M136*J136+L136)	=N136/B$10/B$11/L$4/J$7*I136
137		=L$6/151	6.30034452499971	=J137+O137	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M137*J137+L137)	=N137/B$10/B$11/L$4/J$7*I137
138		=L$6/151	6.30172875323713	=J138+O138	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M138*J138+L138)	=N138/B$10/B$11/L$4/J$7*I138
139		=L$6/151	6.30311235444838	=J139+O139	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M139*J139+L139)	=N139/B$10/B$11/L$4/J$7*I139
140		=L$6/151	6.30449992627531	=J140+O140	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M140*J140+L140)	=N140/B$10/B$11/L$4/J$7*I140
141		=L$6/151	6.30588687135501	=J141+O141	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M141*J141+L141)	=N141/B$10/B$11/L$4/J$7*I141
142		=L$6/151	6.30727318996988	=J142+O142	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M142*J142+L142)	=N142/B$10/B$11/L$4/J$7*I142
143		=L$6/151	6.3086588824022	=J143+O143	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M143*J143+L143)	=N143/B$10/B$11/L$4/J$7*I143
144		=L$6/151	6.31004394893413	=J144+O144	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M144*J144+L144)	=N144/B$10/B$11/L$4/J$7*I144
145		=L$6/151	6.31142838984767	=J145+O145	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M145*J145+L145)	=N145/B$10/B$11/L$4/J$7*I145
146		=L$6/151	6.31281220542473	=J146+O146	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M146*J146+L146)	=N146/B$10/B$11/L$4/J$7*I146
147		=L$6/151	6.31419539594706	=J147+O147	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M147*J147+L147)	=N147/B$10/B$11/L$4/J$7*I147
148		=L$6/151	6.31630974457812	=J148+O148	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M148*J148+L148)	=N148/B$10/B$11/L$4/J$7*I148
149		=L$6/151	6.31842321553289	=J149+O149	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M149*J149+L149)	=N149/B$10/B$11/L$4/J$7*I149
150		=L$6/151	6.32053538921829	=J150+O150	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M150*J150+L150)	=N150/B$10/B$11/L$4/J$7*I150
151		=L$6/151	6.32264668626552	=J151+O151	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M151*J151+L151)	=N151/B$10/B$11/L$4/J$7*I151
152		=L$6/151	6.32475709620993	=J152+O152	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M152*J152+L152)	=N152/B$10/B$11/L$4/J$7*I152
153		=L$6/151	6.32686663024861	=J153+O153	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M153*J153+L153)	=N153/B$10/B$11/L$4/J$7*I153
154		=L$6/151	6.3289752851372	=J154+O154	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M154*J154+L154)	=N154/B$10/B$11/L$4/J$7*I154
155		=L$6/151	6.33108306124156	=J155+O155	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M155*J155+L155)	=N155/B$10/B$11/L$4/J$7*I155
156		=L$6/151	6.33318995892735	=J156+O156	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M156*J156+L156)	=N156/B$10/B$11/L$4/J$7*I156
157		=L$6/151	6.3352959785601	=J157+O157	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M157*J157+L157)	=N157/B$10/B$11/L$4/J$7*I157
158		=L$6/151	6.33788145979333	=J158+O158	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M158*J158+L158)	=N158/B$10/B$11/L$4/J$7*I158
159		=L$6/151	6.34046608861038	=J159+O159	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M159*J159+L159)	=N159/B$10/B$11/L$4/J$7*I159
160		=L$6/151	6.34305284716999	=J160+O160	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M160*J160+L160)	=N160/B$10/B$11/L$4/J$7*I160
161		=L$6/151	6.3456387566735	=J161+O161	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M161*J161+L161)	=N161/B$10/B$11/L$4/J$7*I161
162		=L$6/151	6.34822381740048	=J162+O162	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M162*J162+L162)	=N162/B$10/B$11/L$4/J$7*I162
163		=L$6/151	6.35080802963043	=J163+O163	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M163*J163+L163)	=N163/B$10/B$11/L$4/J$7*I163
164		=L$6/151	6.35339139364273	=J164+O164	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M164*J164+L164)	=N164/B$10/B$11/L$4/J$7*I164
165		=L$6/151	6.35597390971668	=J165+O165	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M165*J165+L165)	=N165/B$10/B$11/L$4/J$7*I165
166		=L$6/151	6.3585555781315	=J166+O166	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M166*J166+L166)	=N166/B$10/B$11/L$4/J$7*I166
167		=L$6/151	6.36113639916629	=J167+O167	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M167*J167+L167)	=N167/B$10/B$11/L$4/J$7*I167
168		=L$6/151	6.36372306119889	=J168+O168	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M168*J168+L168)	=N168/B$10/B$11/L$4/J$7*I168
169		=L$6/151	6.36630882516288	=J169+O169	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(M169*J169+L169)	=N169/B$10/B$11/L$4/J$7*I169

	P	Q	R	S	T	U	V	W
1		Wisconsin Channel						
2								
3		Q	=B3-J3	ft^3/s	=R3*(2.54*12)^3*24*3600	cm^3/day		
4		h	6.8	ft	=R4*2.54*12	cm		
5		Width	620	ft	=R5*12*2.54	cm		
6		L	6.8	mile	=R6*2.54*12*5280	cm		
7		Velocity	=T$3/(T$4*T$5)	cm/day	=R7/24/160934.4	mile/hour		
8					=R6/T7	hours		
9								
10								
11								
12								
13								
14								
15								
16								
17		dx	$T_{stream-1}$	T_{stream}	η	ε	S	delta T
18		cm	°C	°C	$cal/cm^2/day$	$cal/cm^2/day/°C$	$cal/cm^2/day$	°C
19		=T$6/125	6.09795477918083	=R19+W19	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U19*R19+T19)	=V19/B$10/B$11/T$4/R$7*Q19
20		=T$6/125	6.09813506457612	=R20+W20	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U20*R20+T20)	=V20/B$10/B$11/T$4/R$7*Q20
21		=T$6/125	6.09831475117184	=R21+W21	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U21*R21+T21)	=V21/B$10/B$11/T$4/R$7*Q21
22		=T$6/125	6.09849383968599	=R22+W22	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U22*R22+T22)	=V22/B$10/B$11/T$4/R$7*Q22
23		=T$6/125	6.09867233083584	=R23+W23	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U23*R23+T23)	=V23/B$10/B$11/T$4/R$7*Q23
24		=T$6/125	6.09885022533793	=R24+W24	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U24*R24+T24)	=V24/B$10/B$11/T$4/R$7*Q24
25		=T$6/125	6.0990275239081	=R25+W25	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U25*R25+T25)	=V25/B$10/B$11/T$4/R$7*Q25
26		=T$6/125	6.09920422726146	=R26+W26	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U26*R26+T26)	=V26/B$10/B$11/T$4/R$7*Q26
27		=T$6/125	6.09938033611239	=R27+W27	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U27*R27+T27)	=V27/B$10/B$11/T$4/R$7*Q27
28		=T$6/125	6.09952730341647	=R28+W28	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U28*R28+T28)	=V28/B$10/B$11/T$4/R$7*Q28
29		=T$6/125	6.09967368444679	=R29+W29	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U29*R29+T29)	=V29/B$10/B$11/T$4/R$7*Q29
30		=T$6/125	6.09981947994655	=R30+W30	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U30*R30+T30)	=V30/B$10/B$11/T$4/R$7*Q30
31		=T$6/125	6.09996469065818	=R31+W31	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U31*R31+T31)	=V31/B$10/B$11/T$4/R$7*Q31
32		=T$6/125	6.10010931732332	=R32+W32	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U32*R32+T32)	=V32/B$10/B$11/T$4/R$7*Q32
33		=T$6/125	6.10025336068279	=R33+W33	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U33*R33+T33)	=V33/B$10/B$11/T$4/R$7*Q33
34		=T$6/125	6.10039682147667	=R34+W34	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U34*R34+T34)	=V34/B$10/B$11/T$4/R$7*Q34
35		=T$6/125	6.10053970044422	=R35+W35	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U35*R35+T35)	=V35/B$10/B$11/T$4/R$7*Q35
36		=T$6/125	6.10068199832391	=R36+W36	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U36*R36+T36)	=V36/B$10/B$11/T$4/R$7*Q36
37		=T$6/125	6.10082371585346	=R37+W37	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U37*R37+T37)	=V37/B$10/B$11/T$4/R$7*Q37
38		=T$6/125	6.10157383591468	=R38+W38	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U38*R38+T38)	=V38/B$10/B$11/T$4/R$7*Q38
39		=T$6/125	6.10232249805218	=R39+W39	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U39*R39+T39)	=V39/B$10/B$11/T$4/R$7*Q39
40		=T$6/125	6.10331058144431	=R40+W40	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U40*R40+T40)	=V40/B$10/B$11/T$4/R$7*Q40
41		=T$6/125	6.10429707698284	=R41+W41	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U41*R41+T41)	=V41/B$10/B$11/T$4/R$7*Q41
42		=T$6/125	6.10528198654057	=R42+W42	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U42*R42+T42)	=V42/B$10/B$11/T$4/R$7*Q42
43		=T$6/125	6.10626531198824	=R43+W43	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U43*R43+T43)	=V43/B$10/B$11/T$4/R$7*Q43
44		=T$6/125	6.10724705519456	=R44+W44	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U44*R44+T44)	=V44/B$10/B$11/T$4/R$7*Q44
45		=T$6/125	6.10822721802623	=R45+W45	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U45*R45+T45)	=V45/B$10/B$11/T$4/R$7*Q45
46		=T$6/125	6.10920580234792	=R46+W46	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U46*R46+T46)	=V46/B$10/B$11/T$4/R$7*Q46
47		=T$6/125	6.11018281002227	=R47+W47	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U47*R47+T47)	=V47/B$10/B$11/T$4/R$7*Q47
48		=T$6/125	6.11143782401265	=R48+W48	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U48*R48+T48)	=V48/B$10/B$11/T$4/R$7*Q48
49		=T$6/125	6.11269089226652	=R49+W49	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U49*R49+T49)	=V49/B$10/B$11/T$4/R$7*Q49
50		=T$6/125	6.11403191137573	=R50+W50	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U50*R50+T50)	=V50/B$10/B$11/T$4/R$7*Q50
51		=T$6/125	6.11537075313127	=R51+W51	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U51*R51+T51)	=V51/B$10/B$11/T$4/R$7*Q51
52		=T$6/125	6.1167074202423	=R52+W52	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U52*R52+T52)	=V52/B$10/B$11/T$4/R$7*Q52
53		=T$6/125	6.11804191541489	=R53+W53	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U53*R53+T53)	=V53/B$10/B$11/T$4/R$7*Q53
54		=T$6/125	6.119374241352	=R54+W54	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U54*R54+T54)	=V54/B$10/B$11/T$4/R$7*Q54
55		=T$6/125	6.1207044007535	=R55+W55	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U55*R55+T55)	=V55/B$10/B$11/T$4/R$7*Q55
56		=T$6/125	6.12203239631616	=R56+W56	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U56*R56+T56)	=V56/B$10/B$11/T$4/R$7*Q56
57		=T$6/125	6.12335823073366	=R57+W57	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U57*R57+T57)	=V57/B$10/B$11/T$4/R$7*Q57
58		=T$6/125	6.12528484700882	=R58+W58	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U58*R58+T58)	=V58/B$10/B$11/T$4/R$7*Q58
59		=T$6/125	6.12720838276522	=R59+W59	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U59*R59+T59)	=V59/B$10/B$11/T$4/R$7*Q59
60		=T$6/125	6.12959454852297	=R60+W60	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U60*R60+T60)	=V60/B$10/B$11/T$4/R$7*Q60
61		=T$6/125	6.13197789696438	=R61+W61	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U61*R61+T61)	=V61/B$10/B$11/T$4/R$7*Q61
62		=T$6/125	6.13435843099994	=R62+W62	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U62*R62+T62)	=V62/B$10/B$11/T$4/R$7*Q62
63		=T$6/125	6.13673615353727	=R63+W63	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U63*R63+T63)	=V63/B$10/B$11/T$4/R$7*Q63
64		=T$6/125	6.13911106748109	=R64+W64	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U64*R64+T64)	=V64/B$10/B$11/T$4/R$7*Q64
65		=T$6/125	6.14148317573326	=R65+W65	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U65*R65+T65)	=V65/B$10/B$11/T$4/R$7*Q65
66		=T$6/125	6.14385248119277	=R66+W66	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U66*R66+T66)	=V66/B$10/B$11/T$4/R$7*Q66
67		=T$6/125	6.14621898675572	=R67+W67	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U67*R67+T67)	=V67/B$10/B$11/T$4/R$7*Q67
68		=T$6/125	6.14980482571606	=R68+W68	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U68*R68+T68)	=V68/B$10/B$11/T$4/R$7*Q68
69		=T$6/125	6.15338693813595	=R69+W69	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U69*R69+T69)	=V69/B$10/B$11/T$4/R$7*Q69
70		=T$6/125	6.15694309185879	=R70+W70	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U70*R70+T70)	=V70/B$10/B$11/T$4/R$7*Q70
71		=T$6/125	6.16049526532116	=R71+W71	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U71*R71+T71)	=V71/B$10/B$11/T$4/R$7*Q71
72		=T$6/125	6.16404346213945	=R72+W72	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U72*R72+T72)	=V72/B$10/B$11/T$4/R$7*Q72
73		=T$6/125	6.16758768592702	=R73+W73	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U73*R73+T73)	=V73/B$10/B$11/T$4/R$7*Q73
74		=T$6/125	6.17112794029418	=R74+W74	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U74*R74+T74)	=V74/B$10/B$11/T$4/R$7*Q74
75		=T$6/125	6.17466422884818	=R75+W75	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U75*R75+T75)	=V75/B$10/B$11/T$4/R$7*Q75
76		=T$6/125	6.17819655519327	=R76+W76	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U76*R76+T76)	=V76/B$10/B$11/T$4/R$7*Q76
77		=T$6/125	6.18172492293065	=R77+W77	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U77*R77+T77)	=V77/B$10/B$11/T$4/R$7*Q77
78		=T$6/125	6.1846915109561	=R78+W78	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U78*R78+T78)	=V78/B$10/B$11/T$4/R$7*Q78
79		=T$6/125	6.18765482832101	=R79+W79	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U79*R79+T79)	=V79/B$10/B$11/T$4/R$7*Q79
80		=T$6/125	6.19103609616743	=R80+W80	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U80*R80+T80)	=V80/B$10/B$11/T$4/R$7*Q80
81		=T$6/125	6.19441374412421	=R81+W81	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U81*R81+T81)	=V81/B$10/B$11/T$4/R$7*Q81
82		=T$6/125	6.19778777551598	=R82+W82	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U82*R82+T82)	=V82/B$10/B$11/T$4/R$7*Q82
83		=T$6/125	6.20115819366452	=R83+W83	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U83*R83+T83)	=V83/B$10/B$11/T$4/R$7*Q83
84		=T$6/125	6.20452500188872	=R84+W84	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U84*R84+T84)	=V84/B$10/B$11/T$4/R$7*Q84
85		=T$6/125	6.20788820350463	=R85+W85	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U85*R85+T85)	=V85/B$10/B$11/T$4/R$7*Q85
86		=T$6/125	6.21124780182542	=R86+W86	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U86*R86+T86)	=V86/B$10/B$11/T$4/R$7*Q86
87		=T$6/125	6.21460380016141	=R87+W87	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U87*R87+T87)	=V87/B$10/B$11/T$4/R$7*Q87
88		=T$6/125	6.21776435541563	=R88+W88	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U88*R88+T88)	=V88/B$10/B$11/T$4/R$7*Q88
89		=T$6/125	6.22092151332962	=R89+W89	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U89*R89+T89)	=V89/B$10/B$11/T$4/R$7*Q89
90		=T$6/125	6.22427124388033	=R90+W90	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U90*R90+T90)	=V90/B$10/B$11/T$4/R$7*Q90
91		=T$6/125	6.22761758461072	=R91+W91	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U91*R91+T91)	=V91/B$10/B$11/T$4/R$7*Q91
92		=T$6/125	6.23096053856432	=R92+W92	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U92*R92+T92)	=V92/B$10/B$11/T$4/R$7*Q92
93		=T$6/125	6.23430010878208	=R93+W93	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U93*R93+T93)	=V93/B$10/B$11/T$4/R$7*Q93

	P	Q	R	S	T	U	V	W
94		=T$6/125	6.23763629830233	=R94+W94	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U94*R94+T94)	=V94/B$10/B$11/T$4/R$7*Q94
95		=T$6/125	6.24096911016081	=R95+W95	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U95*R95+T95)	=V95/B$10/B$11/T$4/R$7*Q95
96		=T$6/125	6.24429854739066	=R96+W96	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U96*R96+T96)	=V96/B$10/B$11/T$4/R$7*Q96
97		=T$6/125	6.24762461302245	=R97+W97	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U97*R97+T97)	=V97/B$10/B$11/T$4/R$7*Q97
98		=T$6/125	6.25021863122448	=R98+W98	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U98*R98+T98)	=V98/B$10/B$11/T$4/R$7*Q98
99		=T$6/125	6.25281021743667	=R99+W99	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U99*R99+T99)	=V99/B$10/B$11/T$4/R$7*Q99
100		=T$6/125	6.25581969546717	=R100+W100	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U100*R100+T100)	=V100/B$10/B$11/T$4/R$7*Q100
101		=T$6/125	6.25882659825128	=R101+W101	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U101*R101+T101)	=V101/B$10/B$11/T$4/R$7*Q101
102		=T$6/125	6.26183092790693	=R102+W102	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U102*R102+T102)	=V102/B$10/B$11/T$4/R$7*Q102
103		=T$6/125	6.26483268655033	=R103+W103	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U103*R103+T103)	=V103/B$10/B$11/T$4/R$7*Q103
104		=T$6/125	6.26783187629602	=R104+W104	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U104*R104+T104)	=V104/B$10/B$11/T$4/R$7*Q104
105		=T$6/125	6.27082849925679	=R105+W105	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U105*R105+T105)	=V105/B$10/B$11/T$4/R$7*Q105
106		=T$6/125	6.27382255754375	=R106+W106	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U106*R106+T106)	=V106/B$10/B$11/T$4/R$7*Q106
107		=T$6/125	6.2768140532663	=R107+W107	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U107*R107+T107)	=V107/B$10/B$11/T$4/R$7*Q107
108		=T$6/125	6.27986129661906	=R108+W108	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U108*R108+T108)	=V108/B$10/B$11/T$4/R$7*Q108
109		=T$6/125	6.2829061286322	=R109+W109	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U109*R109+T109)	=V109/B$10/B$11/T$4/R$7*Q109
110		=T$6/125	6.28681420380785	=R110+W110	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U110*R110+T110)	=V110/B$10/B$11/T$4/R$7*Q110
111		=T$6/125	6.29072037786407	=R111+W111	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U111*R111+T111)	=V111/B$10/B$11/T$4/R$7*Q111
112		=T$6/125	6.29462465174416	=R112+W112	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U112*R112+T112)	=V112/B$10/B$11/T$4/R$7*Q112
113		=T$6/125	6.29852702639098	=R113+W113	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U113*R113+T113)	=V113/B$10/B$11/T$4/R$7*Q113
114		=T$6/125	6.30242750274692	=R114+W114	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U114*R114+T114)	=V114/B$10/B$11/T$4/R$7*Q114
115		=T$6/125	6.30632608175385	=R115+W115	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U115*R115+T115)	=V115/B$10/B$11/T$4/R$7*Q115
116		=T$6/125	6.31022276435322	=R116+W116	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U116*R116+T116)	=V116/B$10/B$11/T$4/R$7*Q116
117		=T$6/125	6.31411755148596	=R117+W117	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U117*R117+T117)	=V117/B$10/B$11/T$4/R$7*Q117
118		=T$6/125	6.3175476700406	=R118+W118	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U118*R118+T118)	=V118/B$10/B$11/T$4/R$7*Q118
119		=T$6/125	6.32097614364878	=R119+W119	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U119*R119+T119)	=V119/B$10/B$11/T$4/R$7*Q119
120		=T$6/125	6.32401472613874	=R120+W120	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U120*R120+T120)	=V120/B$10/B$11/T$4/R$7*Q120
121		=T$6/125	6.32705178282947	=R121+W121	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U121*R121+T121)	=V121/B$10/B$11/T$4/R$7*Q121
122		=T$6/125	6.33008731455329	=R122+W122	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U122*R122+T122)	=V122/B$10/B$11/T$4/R$7*Q122
123		=T$6/125	6.33312132214205	=R123+W123	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U123*R123+T123)	=V123/B$10/B$11/T$4/R$7*Q123
124		=T$6/125	6.33615380642713	=R124+W124	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U124*R124+T124)	=V124/B$10/B$11/T$4/R$7*Q124
125		=T$6/125	6.33918476823946	=R125+W125	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U125*R125+T125)	=V125/B$10/B$11/T$4/R$7*Q125
126		=T$6/125	6.34221420840943	=R126+W126	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U126*R126+T126)	=V126/B$10/B$11/T$4/R$7*Q126
127		=T$6/125	6.34524212776703	=R127+W127	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U127*R127+T127)	=V127/B$10/B$11/T$4/R$7*Q127
128		=T$6/125	6.34847940036797	=R128+W128	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U128*R128+T128)	=V128/B$10/B$11/T$4/R$7*Q128
129		=T$6/125	6.3517148808631	=R129+W129	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U129*R129+T129)	=V129/B$10/B$11/T$4/R$7*Q129
130		=T$6/125	6.35481377741697	=R130+W130	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U130*R130+T130)	=V130/B$10/B$11/T$4/R$7*Q130
131		=T$6/125	6.35791086005827	=R131+W131	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U131*R131+T131)	=V131/B$10/B$11/T$4/R$7*Q131
132		=T$6/125	6.36100612993049	=R132+W132	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U132*R132+T132)	=V132/B$10/B$11/T$4/R$7*Q132
133		=T$6/125	6.36409958817637	=R133+W133	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U133*R133+T133)	=V133/B$10/B$11/T$4/R$7*Q133
134		=T$6/125	6.3671912359379	=R134+W134	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U134*R134+T134)	=V134/B$10/B$11/T$4/R$7*Q134
135		=T$6/125	6.37028107435632	=R135+W135	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U135*R135+T135)	=V135/B$10/B$11/T$4/R$7*Q135
136		=T$6/125	6.37336910457214	=R136+W136	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U136*R136+T136)	=V136/B$10/B$11/T$4/R$7*Q136
137		=T$6/125	6.37645532772511	=R137+W137	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U137*R137+T137)	=V137/B$10/B$11/T$4/R$7*Q137
138		=T$6/125	6.37944723190534	=R138+W138	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U138*R138+T138)	=V138/B$10/B$11/T$4/R$7*Q138
139		=T$6/125	6.38243734239026	=R139+W139	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U139*R139+T139)	=V139/B$10/B$11/T$4/R$7*Q139
140		=T$6/125	6.38491719994556	=R140+W140	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U140*R140+T140)	=V140/B$10/B$11/T$4/R$7*Q140
141		=T$6/125	6.3873954528595	=R141+W141	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U141*R141+T141)	=V141/B$10/B$11/T$4/R$7*Q141
142		=T$6/125	6.38987210223518	=R142+W142	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U142*R142+T142)	=V142/B$10/B$11/T$4/R$7*Q142
143		=T$6/125	6.3923471491749	=R143+W143	=-0.00761*B$12*B$14*B$13-1.7935*B$12*B$14-0.03*B$12*B$13-25*B$12-0.15921*B$14*B$13+16.6865*B$14-0.93*B$13-15	=30.912-1.088*B$12+3.1522*B$14-0.03*B$13	=-(U143*R143+T143)	=V143/B$10/B$11/T$4/R$7*Q143
144								
145								
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167								
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169								

Document1

```
Sub River_Flows()
'
' River_Flows Macro
' Keyboard Shortcut: Ctrl+Shift+R
'
    Application. screenUpdating = False

' Update Upstream Temp 31 times = 1 month
    Dim k As Integer
    k = 0
    While k < Sheets("Paily").Range("F15")

    Sheets("Paily").Range("B15").Value = Sheets("Upstream_Temps").Cells(k + 2, 3)

' Update Met 24 times = 24 hours
    Dim j As Integer
    j = 0
    While j < 24

    Sheets("Paily").Range("B12").Value = Sheets("met").Cells(k * 24 + j + 4, 2)
    Sheets("Paily").Range("B13").Value = Sheets("met").Cells(k * 24 + j + 4, 8)
    Sheets("Paily").Range("B14").Value = Sheets("met").Cells(k * 24 + j + 4, 9)

' Update Temps 10 times = 1 hours
    Dim i As Integer
    i = 0
    While i < 10

    Sheets("Paily").Range("S19:S142").Copy
    Sheets("Paily").Range("R20:R143").PasteSpecial Paste:=xlPasteValuesAndNumberFormats
    Sheets("Paily").Range("K19:K168").Copy
    Sheets("Paily").Range("J20:J169").PasteSpecial Paste:=xlPasteValuesAndNumberFormats
    Sheets("Paily").Range("C60").Copy
    Sheets("Paily").Range("J19").PasteSpecial Paste:=xlPasteValuesAndNumberFormats
    Sheets("Paily").Range("R19").PasteSpecial Paste:=xlPasteValuesAndNumberFormats
    Sheets("Paily").Range("C19:C59").Copy
    Sheets("Paily").Range("B20:B60").PasteSpecial Paste:=xlPasteValuesAndNumberFormats

    i = i + 1
    Wend

' Hourly Results
    Sheets("Results").Cells(k * 24 + j + 2, 2).Value = Sheets("Paily").Range("C60")
    Sheets("Results").Cells(k * 24 + j + 2, 3).Value = Sheets("Paily").Range("K169")
    Sheets("Results").Cells(k * 24 + j + 2, 4).Value = Sheets("Paily").Range("S143")
    Sheets("Results").Cells(k * 24 + j + 2, 5).Value = Sheets("Paily").Range("F10")

    Application.ScreenUpdating = True
    Sheets("Chart1").Select
    Application.ScreenUpdating = False

    j = j + 1
    Wend

    k = k + 1
    Wend
End Sub
```

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

ENVIRONMENTAL MONITORING PROGRAM

1981 ANNUAL REPORT

LAKE PEPIN ICE AND WATER TEMPERATURE SURVEY

by

Kenneth N. Mueller

Environmental and Regulatory Activities Department

Northern States Power Company

LAKE PEPIN ICE AND WATER TEMPERATURE SURVEY

INTRODUCTION

Cooling water system modifications at Prairie Island Nuclear Generating Plant (PINGP) will result in increased discharge of heated water to the Mississippi River during winter open-cycle operation. A monitoring program to provide background data was initiated February 24, 1981 to determine effects on ice cover and water temperature of Lake Pepin. Lake Pepin is a river lake approximately 21 miles long and 2-1/2 miles maximum width. The head of the lake, at River Mile 785.0, is approximately 13 miles downstream of PINGP. Depending on ice thickness and snow depth, the lower three-fourths of the lake receives considerable recreational and commercial use such as, ice fishing, snowmobiling, and commercial fishing.

METHODS AND MATERIALS

Five transects were established across Lake Pepin (Table 1 and Figure 1). Three points were monitored per transect: Point A - Minnesota side, Point B - middle, and Point C - Wisconsin side. Sampling frequency was scheduled at two-week intervals (depending on safe ice conditions).

Monitoring included: Measurement of ice thickness to nearest inch; water temperature to nearest one-tenth degree centigrade at surface and one meter intervals, with YSI Model 46-TUC Tele-thermometer; visual observations from shore, of extent of ice cover near the head of the lake; and log recreational and/or commercial activities.

Visual observations of ice cover at the head of the lake were made from Greene Point, Wacouta. Notes on recreational and commercial activities included: Car, truck, and snowmobile traffic on the lake; number of ice fishing shelters in general vicinity of survey transects; and number of ice fishermen and commercial fishermen on the lake.

RESULTS AND DISCUSSION

The monitoring program was not initiated until late February as a requirement stipulated by MDNR personnel and included in the Prairie Island NPDES permit. Because of time restrictions and unsafe ice conditions, limited data were collected during 1981. All data and notes are included in Tables 2 through 4. The first barge of the commercial shipping season passed through Lake Pepin March 9, 1981, which resulted in termination of the monitoring program for 1981.

Table 1. Transects Surveyed for Ice Thickness and Water Temperature on Lake Pepin, 1981.

	Approximate River Mile	Minnesota	To	Wisconsin
Transect 1	780.0	Point-No-Point		*Maiden Rock (City of) (Boat Ramp)
Transect 2	777.5	*Long Point		Recreational Site (Wayside Rest Area)
Transect 3	774.3	*Central Point		*Stockholm (City of)
Transect 4	770.0	Riley Coulee		*Deer Island (Recreational site/ boat ramp)
Transect 5	767.0	Maple Springs (King Coulee)		*Pepin (City of)
Greene Point	783.3	Observations from shore, only		

*Points of Access Used During Survey

Table 2. Notes from Observations Made February 24, 1981 for Lake Pepin Ice Thickness and Water Temperature Survey.

1. Lake City - Lake Pepin ice covered except 15-25' out from shore.

2. Camp Lacupolis - (Lower End of Lake Pepin) Open water from here downstream.

Generally - No ice houses, snowmobile traffic, or recreational activity on Lake Pepin.

Investigating the possibility of using snowmobile for survey in the future.

March 9, 1981

First barge of shipping season passed through Lake Pepin.

End of ice thickness and water temperature survey.

Table 3. Lake Pepin Ice Thickness and Water Temperature Survey Data Collected March 2, 1981.

Transect 5

Point A		Point B	Point C
- Ice Depth = 18"		!	!
- Temperature		!	!
		!	!
Surface	0.5°C	!	!
1 Meters	1.8	N	N
2	1.7	O	O
3	1.7		
4	1.7	D	D
5	1.6	A	A
6	1.6	T	T
7	1.6	A	A
8	1.6	!	!
9	2.1	!	!
10 (Bottom)	2.2	!	!

Notes (Transect 5) - Two fishermen for sauger - one fish.

Transect 4 - No Data

Transect 3 - No Data

Transect 2 - No Data

Transect 1 - No Data

Greene Point - Open water from head of lake to first point below Greene Point.

Open water extended approximately half way across lake.

Table 4. Lake Pepin Ice Thickness and Water Temperature Survey Data from March 6, 1981.

Transect 1

No Data - Unsafe ice at access.

Transect 2

No Data - Unsafe ice at access.

Transect 3

	Point A	Point B	Point C
Ice Thickness	18"	21"	23"
Temperature			
Surface	1.1°C	1.0°C	1.4°C
1 (Meter)	1.7	1.5	1.8
2	1.8	1.6	1.9
3	1.8	1.6	1.9
4	1.8	1.7	2.2
5	1.8	1.8	2.3
6	1.8	1.9	2.3
7	1.8	1.9	2.3
8	1.8	2.0	2.3
9	1.9	2.0	Bottom 24'
10	1.9	Bottom 28'	
	Bottom 31'		

Transect 4

	Point A	Point B	Point C
Ice Thickness	18"	18"	18"
Temperature			
Surface	1.3°C	1.8°C	2.2°C

Table 4. (Continued)

	Point A	Point B	Point C
1 (Meter)	1.7°C	2.4°C	3.0°C
2	1.8	2.0	3.0
3	1.8	2.2	2.6
4	2.0	2.4	2.4
5	2.2	2.5	2.4
6	2.2	2.6	2.7
7	2.3	2.6	3.0
8	2.5	2.7	3.0
9	2.5	Bottom 24'	Bottom 24'
	Bottom 28'		

Transect 5

	Point A	Point B	Point C
Ice Thickness	18"	18"	18"
Temperature			
Surface	1.8°C	2.4°C	1.1°C
1 (Meter)	2.6	2.5	2.1
2	2.6	2.4	2.3
3	2.2	2.3	2.2
4	2.0	2.2	2.1
5	2.0	2.1	2.3
6	2.0	2.0	2.4
7	2.0	1.9	2.6
8	2.0	2.1	Bottom 24'
9	2.2	Bottom 24'	
10	2.3		
	Bottom 31"		

Figure 1.

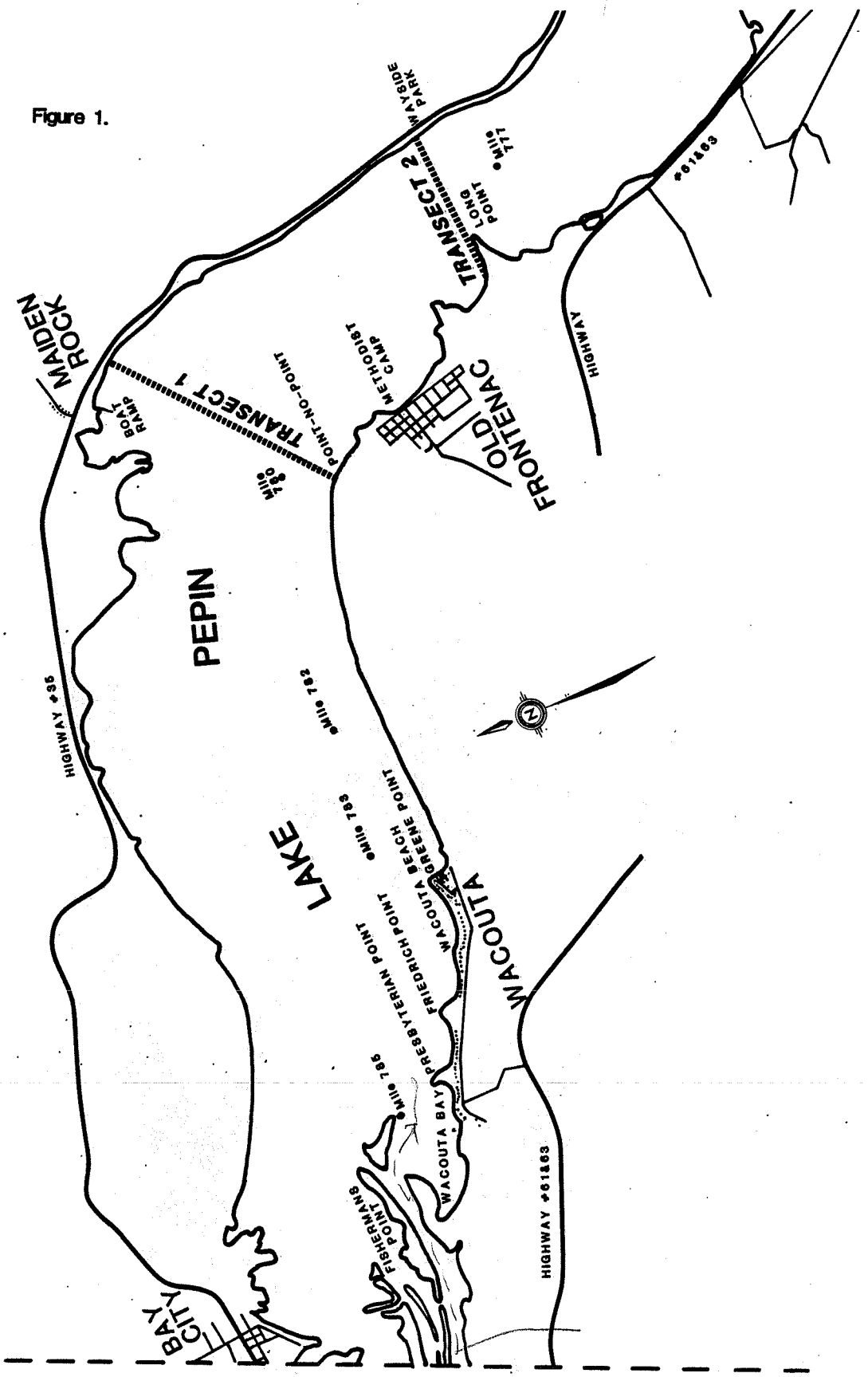
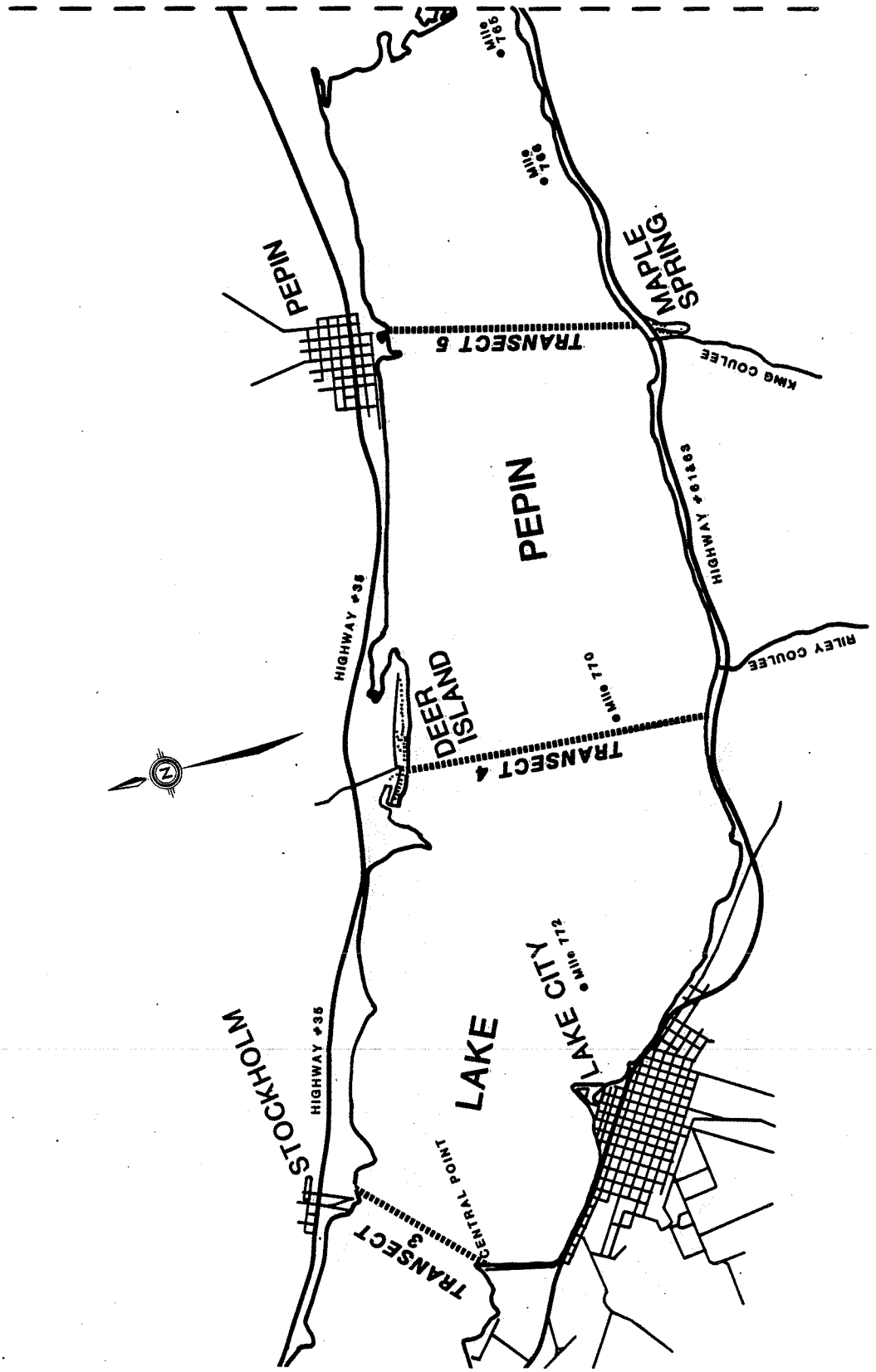

MAIDEN ROCK
BOAT RAMP
TRANSECT 1
POINT-NO-POINT
MILE 780
METHODIST CAMP
TRANSECT 2
LONG POINT
MILE 777
WAYSIDE PARK
OLD FRONTENAC
HIGHWAY #61&63
HIGHWAY
PEPIN
LAKE
MILE 782
MILE 783
MILE 785
HIGHWAY #35
FRIEDRICH POINT
WACOUTA BEACH
GREENE POINT
WACOUTA BAY
WACOUTA
FISHERMANS POINT
HIGHWAY #61&63
BAY CITY
N

Figure 1. (Continued)



PRAIRIE ISLAND NUCLEAR GENERATING PLANT

ENVIRONMENTAL MONITORING PROGRAM

1982 ANNUAL REPORT

LAKE PEPIN ICE THICKNESS AND WATER TEMPERATURE SURVEY

by

Kenneth N. Mueller

Environmental and Regulatory Activities Department

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LAKE PEPIN ICE THICKNESS AND WATER TEMPERATURE SURVEY

INTRODUCTION

Cooling water system modifications at Prairie Island Nuclear Generating Plant (PINGP) will result in increased discharge of heated water to the Mississippi River during winter open-cycle operation. A monitoring program to provide background data was initiated in 1981 to determine effects on Lake Pepin ice cover and water temperature. Monitoring in 1982 was conducted January through mid-March. Lake Pepin is a river lake approximately 21 miles long and 2.5 miles maximum width. The head of the lake, at River Mile 785.0, is approximately 13 miles downstream of PINGP. Depending on ice thickness and snow depth, the lower three-fourths of the lake receives considerable recreational and commercial use such as, ice fishing, snowmobiling, and commercial fishing.

METHODS AND MATERIALS

Five transects were established across Lake Pepin (Table 1 and Figure 1). Five points, "A" through "E", were monitored per transect, with Point "A" on the Minnesota side, and Point "E" on the Wisconsin side. Sampling frequency was scheduled at two-week intervals, depending on safe ice conditions. Monitoring, in 1982, commenced January 5 and ended March 2.

The following procedures were used when collecting data presented in Tables 2 through 6. Ice and snow depth were measured to the nearest inch. Snow depth varied greatly due to drifting. Average snow depth was recorded at each transect point. Water temperature was recorded to the nearest two-tenths of one degree Centigrade and measured at one-yard intervals, surface to bottom, with a YSI Model 46-TUC Tele-thermometer. Surface water temperatures, listed as zero (0) yards depth, were actually

measured directly beneath the ice. Bottom depth, in feet, was recorded following the last temperature at each transect point. Notes on visual observations from shore, of the extent of ice cover near the head of the lake, are presented in Table 7. The observations were made from Greene Point, Wacouta (Figure 1). The Sturgeon Lake (SL) transect is located on a backwater lake above Lock and Dam 3 and serves as a control transect. It is not shown on the Lake Pepin area map (Figure 1). A log of recreational and commercial activities in the vicinity of the survey transects is on file at the P. I. Environmental Lab. The log includes notes on: car, truck, and snowmobile traffic on the lake; number of ice fishing shelters in the general vicinity of the transects; and numbers of ice-fishermen and commercial fishermen on the lake.

RESULTS AND DISCUSSION

The Lake Pepin monitoring program is a requirement stipulated by Minnesota Department of Natural Resources personnel and included in the Prairie Island NPDES permit. Survey data collected in 1982 are presented as background information to be used for future comparison of Lake Pepin ice cover and water temperature after the modified intake and discharge at Prairie Island become operational. Monitoring was conducted every two weeks beginning January 6 through March 2, 1982. An attempt was made to monitor on March 17 also, but open water near shore and hazardous ice conditions limited the survey activities to observations from shore, only. No recreational activities were noted on the lake at that time. The first barge of the commercial shipping season broke through the remaining ice on Lake Pepin March 25, terminating the monitoring program for 1982.

Table 1. Transects Surveyed for Ice Thickness and Water Temperature on Lake Pepin, 1982

	Approximate River Mile	Minnesota	To	Wisconsin
Transect 1	780.0	Point-No-Point		*Maiden Rock (City of) (Boat Ramp)
Transect 2	777.5	*Long Point		Recreational Site (Wayside Rest Area)
Transect 3	774.3	*Central Point		*Stockholm (City of)
Transect 4	770.0	Riley Coulee		*Deer Island (Recreational site/ Boat ramp)
Transect 5	767.0	Maple Springs (King Coulee)		*Pepin (City of)
Greene Point	783.3	Observations from shore, only		

*Points of Access Used During Survey

TABLE 2. Lake Pepin Ice Thickness and Water Temperature Survey Data. Monitoring Date 1-6-82; Water Temp.(Centigrade); Bottom Depth (feet); Ice and Snow Depth (inches).

DEPTH (yds)	TRANSECT 1 A	B	C	D	E	TRANSECT 2 A	B	C	D	E	TRANSECT 3 A	B	C	D	E
0	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
1	.2	.2	.2	.2	.2	.4	.2	.2	.2	.2	.2	.2	.2	.2	.2
2	.2	.2	.2	.2	.6	.4	.2	.2	.2	.2	.2	.2	.2	.2	.2
3	.2	.2	.2	.4	1.4	.4	.2	.2	.2	.2	.2	.2	.2	.2	.2
4	.2	.4	.2	1.2	9'	.4	.2	.2	.2	.2	.2	.2	.2	.2	.2
5	.2	.4	1.4	1.6		.4	.2	.2	.2	.2	.4	.2	.2	.2	.4
6	.2	.2	1.2	15'		.4	.4	.2	.6	.2	.4	.8	.6	1.4	2.0
7	.2	.2	18'			19'	.4	.8	1.0	2.0	.4	.8	1.0	1.8	2.0
8	22'	20'					.4	.8	1.2	20'	.6	.8	1.2	1.8	2.0
9							.4	24'	23'		.6	1.0	1.2	24'	24'
10							26'				.6	27'	26'		
											30'				
ICE	11"	9"	9"	9"	9"	11"	8"	11"	13"	11"	13"	7"	9"	15"	12"
SNOW	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"

DEPTH (yds)	TRANSECT 4 A	B	C	D	E	TRANSECT 5 A	B	C	D	E	TRANSECT SL A	B	C	D	E
0	.2	.2	.2	.2	.2	.6	.2	.2	.2	.2	.2	.2	.2	.2	.2
1	.2	.2	.2	.2	.2	.6	.2	.2	.2	.2	2'	.2	.2	.2	.2
2	.2	.2	.2	.2	.2	.8	.4	.2	.2	.2		3'	.2	3'	3'
3	.2	.2	.2	.2	.2	.8	.4	.2	.2	.2			.2		
4	.2	.2	.2	.2	1.0	.8	.4	.2	.2	.8			9'		
5	.2	.2	.2	.2	1.8	.8	.4	.4	.8	1.2					
6	.4	.2	.4	.8	2.2	1.0	.8	1.0	1.2	2.2					
7	.4	.2	.8	1.4	2.4	1.0	1.4	2.2	2.2	2.4					
8	.6	.2	1.2	1.6	21'	1.2	2.2	2.4	2.4	2.6					
9	.8	1.4	25'	24'		1.8	2.4	2.4	24'	23'					
10	1.2	26'				2.4	29'	28'							
11	29'					2.4									
						33'									
ICE	12"	8"	9"	10"	13"	8"	8"	8"	8"	9"	11"	11"	11"	9"	13"
SNOW	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"

TABLE 3. Lake Pepin Ice Thickness and Water Temperature Survey Data. Monitoring Date 1-20-82; Water Temp.(Centigrade); Bottom Depth (feet); Ice and Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.2	.2	.2	.2	.8	.2	.2	.2	.2	.4	.2	.2	.2	.2	.2
1	.2	.2	.2	.2	.8	.2	.2	.2	.2	.4	.2	.2	.2	.2	.2
2	.2	.2	.2	.2	.6	.2	.2	.2	.2	.4	.2	.2	.2	.2	.2
3	.2	.2	.2	.2	.6	.2	.2	.2	.2	.4	.2	.2	.2	.2	.2
4	.2	.2	.2	.4	.8	.2	.2	.2	.2	.4	.2	.2	.2	.2	.2
5	.2	.4	.2	1.4	10'	.2	.2	.2	.2	.4	.4	.2	.2	.2	.2
6	.2	.4	1.4	1.4		.2	.2	.2	.2	.4	.4	.2	.2	.2	1.8
7	.2	1.2	18'	16'		.4	.8	1.2	1.6	1.6	.4	.8	.2	1.8	2.0
8	21'	21'				21'	1.6	1.6	21'	20'	.4	1.0	1.8	2.0	2.0
9							1.6	23'			.6	1.6	2.0	24'	24'
10							25'				.8	27'	25'		
11											1.2				
											32'				
ICE	15"	17"	14"	20"	21"	21"	20"	22"	20"	15"	21"	20"	22"	21"	17"
SNOW	8"	7"	8"	6"	6"	0"	0"	0"	0"	0"	0"	0"	0"	0"	0"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.2	.2	.2	.2	.2	.4	.8	.4	.2	.2	.2	.2	.2	.2	.2
1	.2	.2	.2	.2	.2	.4	.8	.4	.2	.2	.2	.2	.2	2'	2'
2	.2	.2	.2	.2	.2	.4	.8	.4	.2	.2	3'	3'	3'		
3	.2	.2	.2	.2	.2	.4	.8	.4	.4	.2					
4	.2	.2	.2	.2	.2	.4	.8	.4	.4	.2					
5	.4	.2	.2	.2	.6	.4	.8	.4	.4	.2					
6	.6	.2	.4	1.8	1.8	.4	1.0	.6	.4	.6					
7	.6	.6	1.2	2.0	2.0	.4	1.2	1.0	1.6	17'					
8	.8	.8	2.0	2.0	21'	.4	1.2	2.2	2.2						
9	1.0	1.4	2.0	22'		.4	1.4	2.2	23'						
10	1.2	1.8	25'			.6	2.6	25'							
11	30'	28'				1.2	29'								
						31'									
ICE	19"	22"	14"	15"	15"	12"	12"	13"	16"	19"	13"	15"	17"	20"	15"
SNOW	8"	7"	6"	6"	9"	9"	6"	6"	4"	3"	0"	0"	0"	0"	0"

TABLE 4. Lake Pepin Ice Thickness and Water Temperature Survey Data. Monitoring Date 2-8-82; Water Temp.(Centigrade); Bottom Depth (feet); Ice and Snow Depth (inches).

DEPTH (yds)	TRANSECT 1 A	B	C	D	E	TRANSECT 2 A	B	C	D	E	TRANSECT 3 A	B	C	D	E
0	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
1	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
3	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
4	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
5	.2	.4	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
6	.2	.4	.2	.8	14'	.2	.2	.2	.2	.2	.2	.2	.2	.2	1.2
7	.2	1.2	1.4	17'		.2	.6	.2	.2	16'	.2	.2	.2	1.8	1.8
8	.2	21'	19'			.4	1.0	1.4	1.4		.2	.2	.4	1.8	2.0
9	23	'				24'	1.4	24'	23'		.6	.2	1.8	2.0	23'
10							27'				1.4	1.8	27'	25'	
11											1.6	29'			
											33'				
ICE	19"	17"	18"	21"	20"	15"	20"	20"	17"	15"	22"	16"	20"	21"	23"
SNOW	12"	3"	8"	11"	10"	12"	9"	11"	9"	14"	4"	12"	11"	10"	10"

DEPTH (yds)	TRANSECT 4 A	B	C	D	E	TRANSECT 5 A	B	C	D	E	TRANSECT SL A	B	C	D	E
0	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	.2	.2	.2	.2	.2
1	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	.2	2'	.2	.2	2'
2	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	3'		.2	3'	
3	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0			.2		
4	.2	.0	.0	.0	.2	.2	.0	.0	.0	.0			.2		
5	.2	.0	.0	.2	.4	.2	.0	.0	.0	.0			.2		
6	.2	.2	.6	.8	.6	.2	.0	.0	.0	.4			.2		
7	.2	.4	1.8	1.8	17'	.2	.0	.2	.2	17'			17'		
8	.2	.8	2.0	2.0		.4	.0	1.6	1.6						
9	.2	2.0	24'	23'		1.8	2.0	1.8	24'						
10	.2	2.0				1.8	2.0	25'							
	29'	28'				28'	29'								
ICE	20"	13"	14"	25"	19"	18"	21"	16"	15"	16"	16"	14"	16"	16"	13"
SNOW	10"	13"	11"	9"	11"	11"	10"	11"	11"	11"	12"	9"	11"	9"	11"

TABLE 5. Lake Pepin Ice Thickness and Water Temperature Survey Data. Monitoring Date 2-16-82; Water Temp.(Centigrade); Bottom Depth (feet), Ice and Snow Depth (inches).

DEPTH (yds)	TRANSECT 1					TRANSECT 2					TRANSECT 3				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.2	.2	.2	.2	.4	.4	.2	.2	.2	.2	.6	.2	.2	.2	.2
1	.2	.2	.2	.2	.4	.4	.2	.2	.2	.2	.6	.2	.2	.2	.2
2	.2	.2	.2	.2	.4	.4	.2	.2	.2	.2	.6	.2	.2	.2	.2
3	.2	.2	.2	.2	.4	.4	.2	.2	.2	.2	.6	.2	.2	.2	.2
4	.2	.2	.2	.4	.8	.4	.2	.2	.2	.2	.6	.2	.2	.2	.2
5	.2	.4	.4	1.4	11'	.4	.4	.2	.2	.2	.6	.2	.2	.2	.6
6	.2	.4	1.4	1.6		.4	.4	.2	.2	.2	.6	.4	.2	.2	1.2
7	.2	.4	1.6	16'		.4	.4	.6	1.6	18'	.6	.4	.8	1.6	2.0
8	.2	21'	19'			.4	.4	1.4	1.6		.6	.6	1.4	2.2	2.2
9	22'					.4	.4	24'	22'		.6	.6	2.0	2.2	23'
10						26	'27	'			1.6	1.4	27'	25'	
11											2.0	1.8			
											33'	33'			
ICE	21"	20"	19"	18"	19"	22"	17"	19"	19"	20"	24"	20"	22"	23"	20"
SNOW	8"	6"	6"	13"	11"	9"	9"	10"	11"	7"	4"	9"	8"	11"	9"

DEPTH (yds)	TRANSECT 4					TRANSECT 5					TRANSECT SL				
	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
0	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2
1	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	17"
2	.2	.2	.2	.2	.2	.4	.2	.2	.2	.2	.2	.2	.2	.2	
3	.2	.2	.2	.2	.2	.4	.2	.2	.2	.2	4'	5'	.2	4'	
4	.4	.2	.2	.2	.6	.4	.2	.2	.2	.2			7'		
5	.4	.2	.2	.2	.8	.4	.2	.2	.2	.4					
6	.4	.6	.6	.8	.8	.4	.2	.2	.2	.4					
7	.4	.8	1.6	2.2	1.0	.6	.4	.4	.8	16'					
8	.6	1.2	2.4	2.2	19'	.6	1.0	1.2	2.0						
9	.6	2.2	2.4	24'		1.4	2.2	2.0	23'						
10	2.0	2.2	26'			1.6	2.2	25'							
	30'	28'				28'	29'								
ICE	21"	17"	18"	26"	20"	24"	21"	19"	26"	21"	22"	20"	13"	20"	17"
SNOW	8"	12"	10"	9"	10"	6"	7"	10"	4"	10"	5"	5"	10"	9"	8"

TABLE 6. Lake Pepin Ice Thickness and Water Temperature Survey Data. Monitoring Date 3-2-82; Water Temp.(Centigrade); Bottom Depth (feet); Ice and Snow Depth (inches).

DEPTH (yds)	TRANSECT 1 A	B	C	D	E	TRANSECT 2 A	B	C	D	E	TRANSECT 3 A	B	C	D	E
0	.4	.2	.2	.2	.2	.4	.4	.2	.2	.2	.4	.4	.2	.2	.2
1	.4	.2	.2	.2	.2	.6	.4	.2	.2	.2	.4	.4	.2	.2	.2
2	.6	.4	.2	.2	.4	.6	.4	.2	.2	.2	.6	.4	.4	.2	.2
3	.6	.6	.8	.2	.6	.6	.4	.4	.2	.2	.8	.4	.4	.2	.2
4	.8	.6	1.0	1.4	1.6	.8	.6	.4	.6	.2	.8	.4	.4	.2	.2
5	.8	.8	1.0	1.8	12'	.8	.8	1.0	1.0	1.4	.8	.8	1.0	1.0	.6
6	.8	1.0	1.0	1.8		.8	1.0	1.0	1.0	1.8	.8	1.0	1.2	1.2	1.2
7	.8	1.0	1.0	16'		.8	1.0	1.0	1.0	17'	.8	1.0	1.2	1.2	1.6
8	.8	21'	19'			.8	1.0	1.0	1.0		.8	1.0	1.2	1.2	2.2
9	23'					.8	1.0	24'	22'		.8	1.0	1.2	24'	24'
10						25'	27'				.8	1.0	27'		
11											.8	29'			
											33'				
ICE	23"	20"	20"	23"	19"	23"	22"	20"	24"	21"	25"	20"	24"	28"	29"
SNOW	2"	2"	2"	4"	4"	4"	3"	4"	2"	2"	1"	5"	5"	4"	5"

DEPTH (yds)	TRANSECT 4 A	B	C	D	E	TRANSECT 5 A	B	C	D	E	TRANSECT SL A	B	C	D	E
0	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.2	.4	.4	.4
1	.4	.4	.2	.2	.2	.4	.2	.2	.2	.2	.2	.2	.6	.6	.6
2	.4	.4	.2	.2	.2	.4	.2	.2	.2	.2	.2	.2	.6	.6	3'
3	.4	.4	.2	.2	.2	.4	.2	.2	.2	.2	4'	6'	6'	4'	
4	.6	.6	.4	.2	.4	.4	.4	.2	.2	.2					
5	.8	.8	1.0	.4	.6	.6	.8	.2	.2	.2					
6	.8	1.0	1.2	.8	1.0	.6	.8	.4	.4	.6					
7	1.0	1.0	1.4	2.2	2.0	.6	1.0	.8	.8	.8					
8	1.0	1.2	2.2	2.8	21'	.8	1.0	2.4	2.4	21'					
9	1.2	2.4	2.8	24'		1.6	2.0	2.4	24'						
10	2.2	2.6	25'			2.0	2.6	25'							
11	30'	28'				29'	30'								
ICE	20"	21"	22"	27"	24"	20"	22"	20"	19"	23"	23"	15"	16"	21"	20"
SNOW	1"	2"	4"	6"	6"	3"	3"	5"	2"	3"	1"	0"	0"	0"	0"

Table 7. Notes from Observations of Ice Cover at the Head of Lake Pepin, Made from Shore at Greene Point, Wacouta.

1-5-82:	Ice cover completely to head of lake
1-19-82:	Lake completely ice and snow covered
2-8-82:	Lake completely ice and snow covered
2-16-82:	No observations recorded
3-2-82:	Approximately 1/4 of lake open water from head of lake to Greene Point; hazardous ice conditions apparent from center of lake to Minnesota shore upstream and directly downstream of Greene Point
3-15-82:	Approximately middle 1/3 of lake open water from head of lake to 1/4 mile downstream of Greene Point; open area below Greene Point much narrower than above. Hazardous ice conditions throughout area

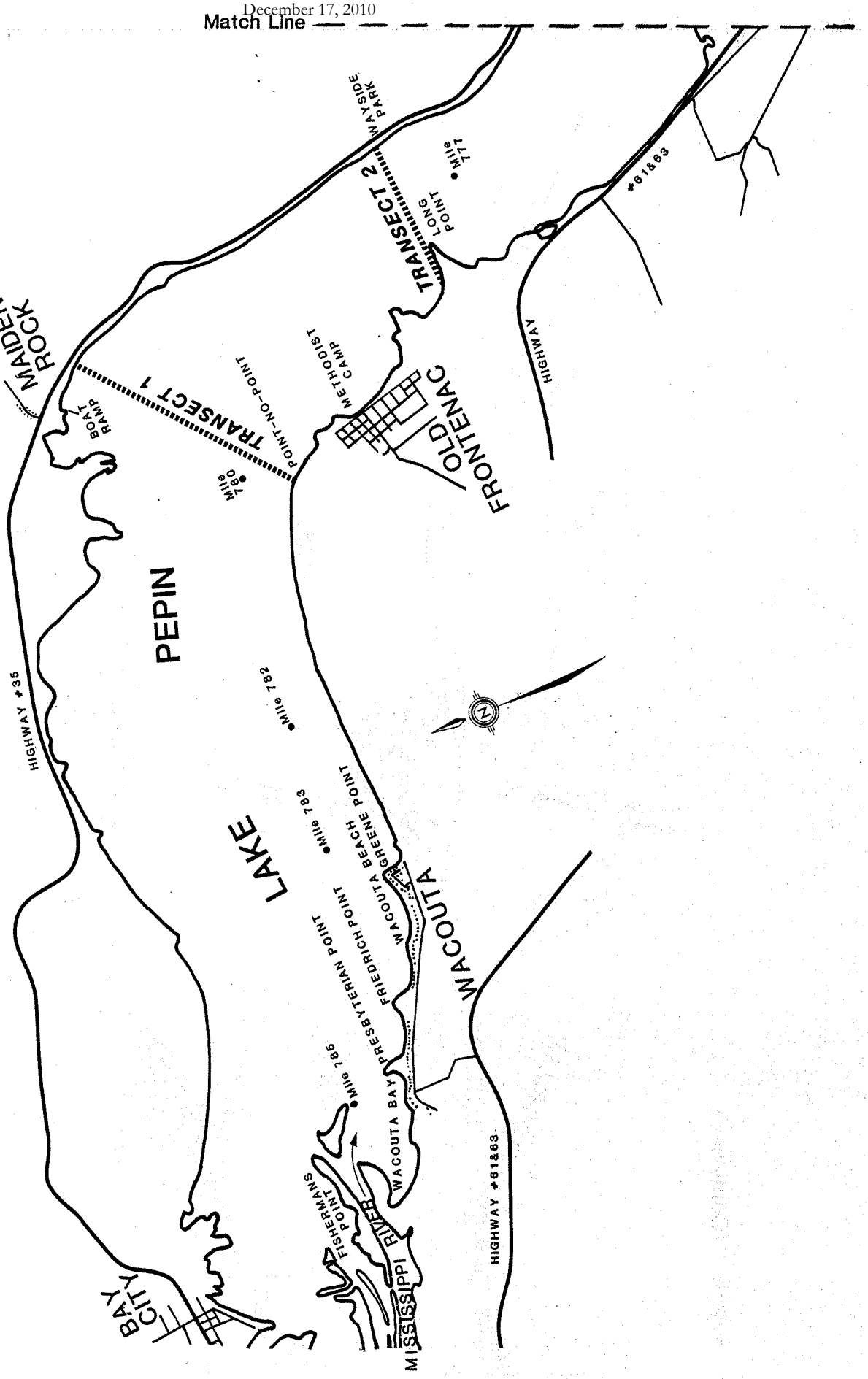
Match Line
MAIDEN ROCK
BOAT RAMP
TRANSECT 1
POINT-NO-POINT
METHODIST CAMP
OLD FRONTENAC
TRANSECT 2
LONG POINT
WAYSIDE PARK
Mile 777
Mile 780
HIGHWAY #61&63
HIGHWAY
HIGHWAY #35
PEPIN
LAKE
Mile 782
Mile 783
Mile 785
FISHERMANS POINT
PRESBYTERIAN POINT
FRIEDRICH POINT
WACOUTA BEACH
GREENE POINT
WACOUTA BAY
WACOUTA
BAY CITY
MISSISSIPPI RIVER
HIGHWAY #61&63
N

Figure 1.