City of River Falls
North Kinnickinnic River Monitoring Project

2005 Summary

Project Introduction

The Kinnickinnic River is one of the premier, naturally sustaining trout fisheries in the Midwest, primarily producing brown trout. There has been a lot of concern about how new developments will affect the river, not only by the increase in runoff and chemicals from lawns, cars, etc., but also from pedestrian traffic. The thermal impacts of untreated storm water are further described on the North Kinni Monitoring website. In 2002, the City adopted a new Storm Water Management Ordinance, which is designed to protect the Kinnickinnic River from the negative impacts of storm water runoff associated with new development. For new development and re-development projects, the City of River Falls Storm Water Management Ordinance requires that, for a 1.5-inch, 24-hour rainfall event, the post-development runoff volume and peak flow rate must not exceed the pre-development runoff volume and peak flow rate. To achieve these requirements, developers must infiltrate water on their site.

To take an active role in the river's health and well-being, the City has implemented a monitoring program aimed at evaluating the effectiveness of our Storm Water Management Ordinance for preventing degradation of the Kinnickinnic River due to new City developments.

Project Scope:

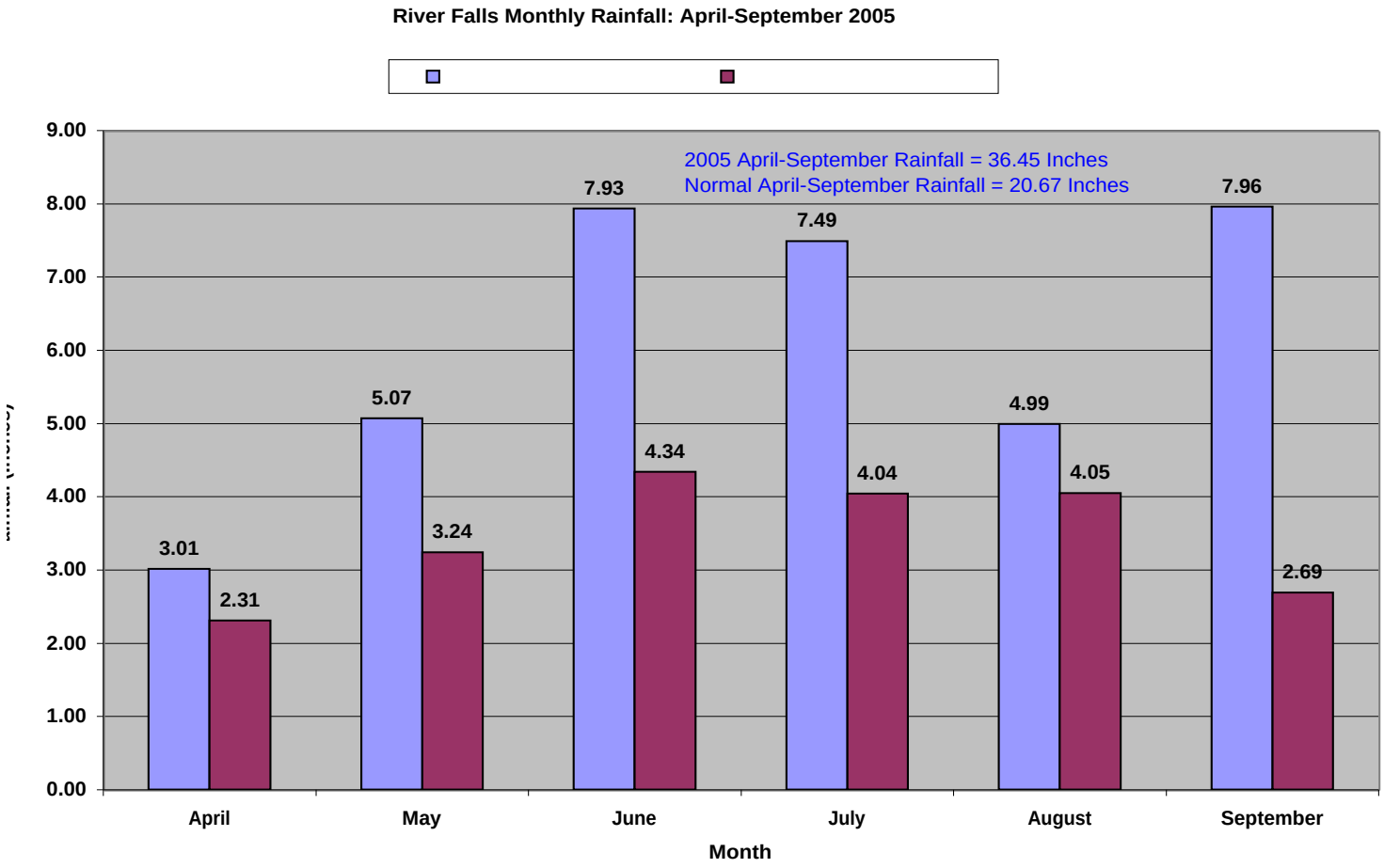
- Temperature Monitoring
- Water Quality Monitoring
- Base Flow Surveys
- Macroinvertebrate Monitoring

The City will examine the long-term results of each of these four monitoring elem ents to determine how new developments, specifically Sterling Ponds Subdivision, are or are not affecting the river under the new storm water ordinance. The project will use an “upstream/downstream” approach to see if the development will make river conditions worse downstream. We will also take a focused look at on-site storm water management practices that are incorporated into new developments. Our hope is that due to the ordinance requirements, the water quality and thermal impacts of development will be undetectable or greatly reduced.

River Falls Precipitation:

Due to the influence of precipitation on river flow, temperature, and water quality, an analysis of annual precipitation is conducted as a part of this project. A total of 36.45 inches of precipitation was recorded in River Falls during the April-September 2005 period, nearly twice the normal total of 20.67 inches for this time period. Rain fell on 71 days, or 39% of the April-September 2005 period.

All months during the April-September 2005 period were wetter than normal, with monthly rainfall amounts exceeding seven inches in June, July, and September. Rainfall amounts in June and July were nearly twice the normal levels, while September rainfall was almost three times the normal level. Nearly 65% of the total April-September rainfall occurred during these three months. The lowest monthly rainfall amount was recorded in April.



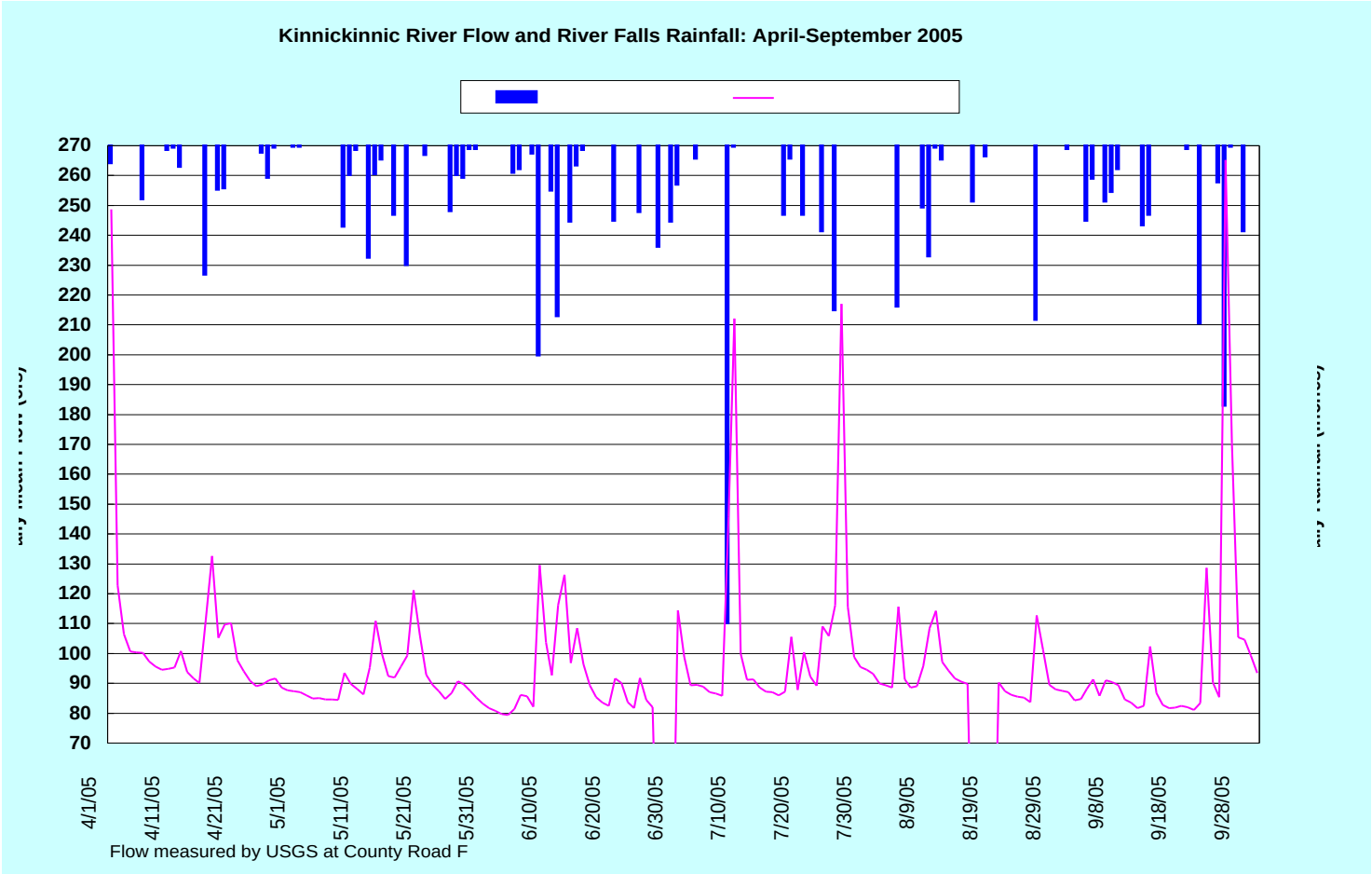
Besides being much wetter than normal, the April-September 2005 monitoring period was warmer than normal. The mean air temperature in River Falls during the April-September 2005 period was 64.6º Fahrenheit (F), nearly 1.5º F higher than the normal mean of 63.2º F for this time period. "Summer" months that

were warmer than normal (June, July, and September) also had the highest rainfall amounts (all in excess of seven inches). The warmer summer weather may have generated more convective thunderstorm activity that produced heavier rainfall.

The City of River Falls Storm Water Management Ordinance would have provided infiltration of approximately 91% (33.01 inches) of the total rainfall (36.45 inches) that occurred during the April-September 2005 period. This percentage was determined using some conservative estimates further described in the technical report.

Kinnickinnic River Flow:

The flow of the Kinnickinnic River is a reflection of precipitation and storm water runoff from predominantly agricultural and urban land uses throughout the 165-square mile Kinnickinnic River Watershed. The daily mean (average) flow of the Kinnickinnic River at County Highway F during the April-September 2005 period is presented in the figure below. Daily rainfall, as measured in River Falls, is also presented in the figure below.



During the April-September 2005 period, rainfall amounts in excess of 1 inch generally had the greatest influence on the Kinnickinnic River hydrograph. Rainfall events on April 16, June 8, June 11, and September 21 resulted in moderate increases in the Kinnickinnic River hydrograph, with peak daily mean flows ranging from 127-133 cfs. Rainfall events on July 8, July 23 and 25, and September 24-25 produced the three largest runoff events of the year, with peak daily mean flows ranging from 212-265 cfs. During dry periods between runoff events, the Kinnickinnic River maintained a base flow condition of approximately 80-90 cfs at County Highway F.

Temperature Monitoring:

Information about the thermal impacts of untreated storm water runoff can be found in the *"Thermal Impacts"* section of the North Kinni Monitoring website.

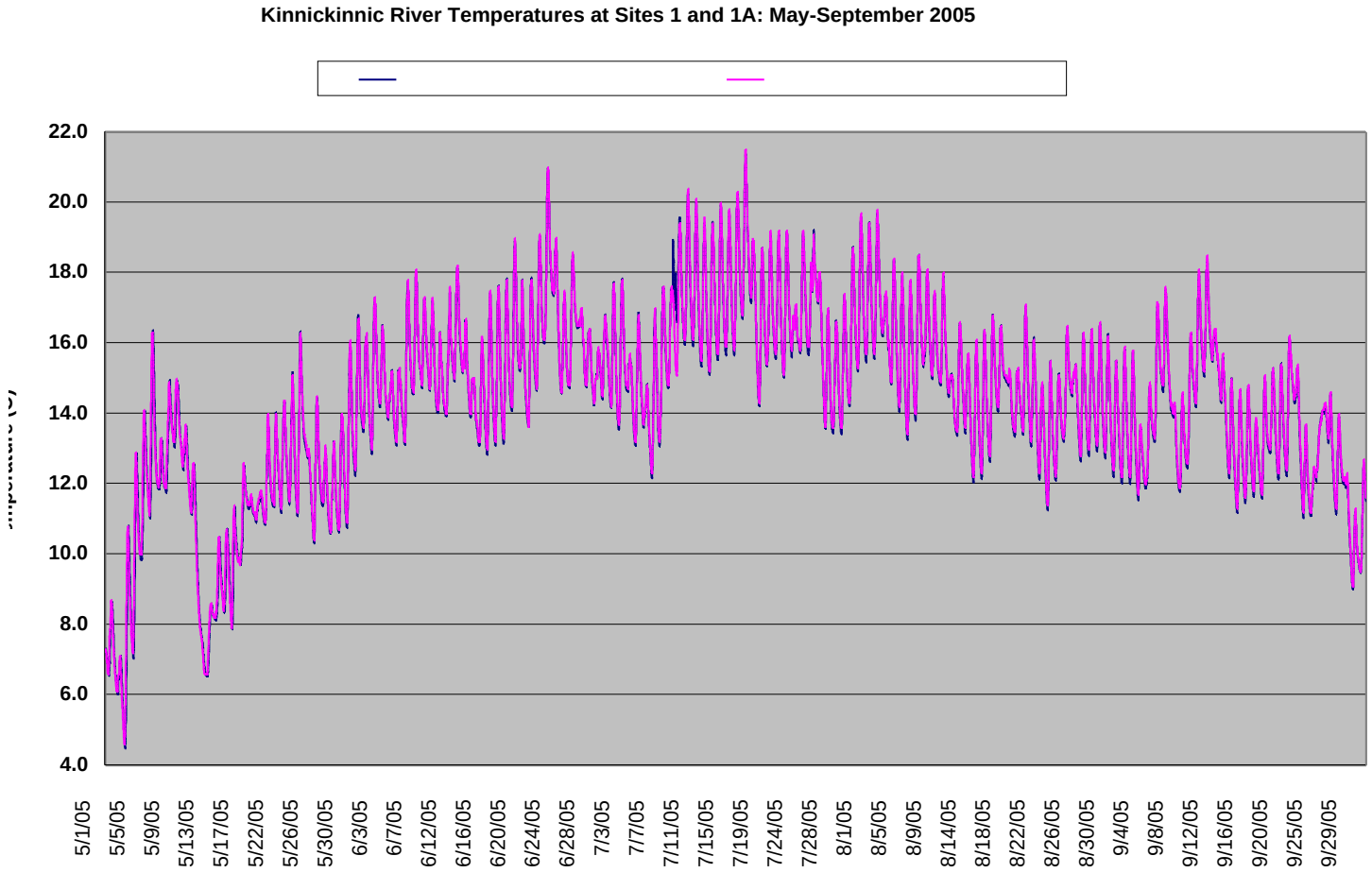
The intent of the City of River Falls Storm Water Management Ordinance is to prevent storm water impacts on the Kinnickinnic River, including thermal pollution, in areas of the city with new development, such as the Sterling Ponds Subdivision.

A direct storm sewer discharge to the Kinnickinnic River at Division Street

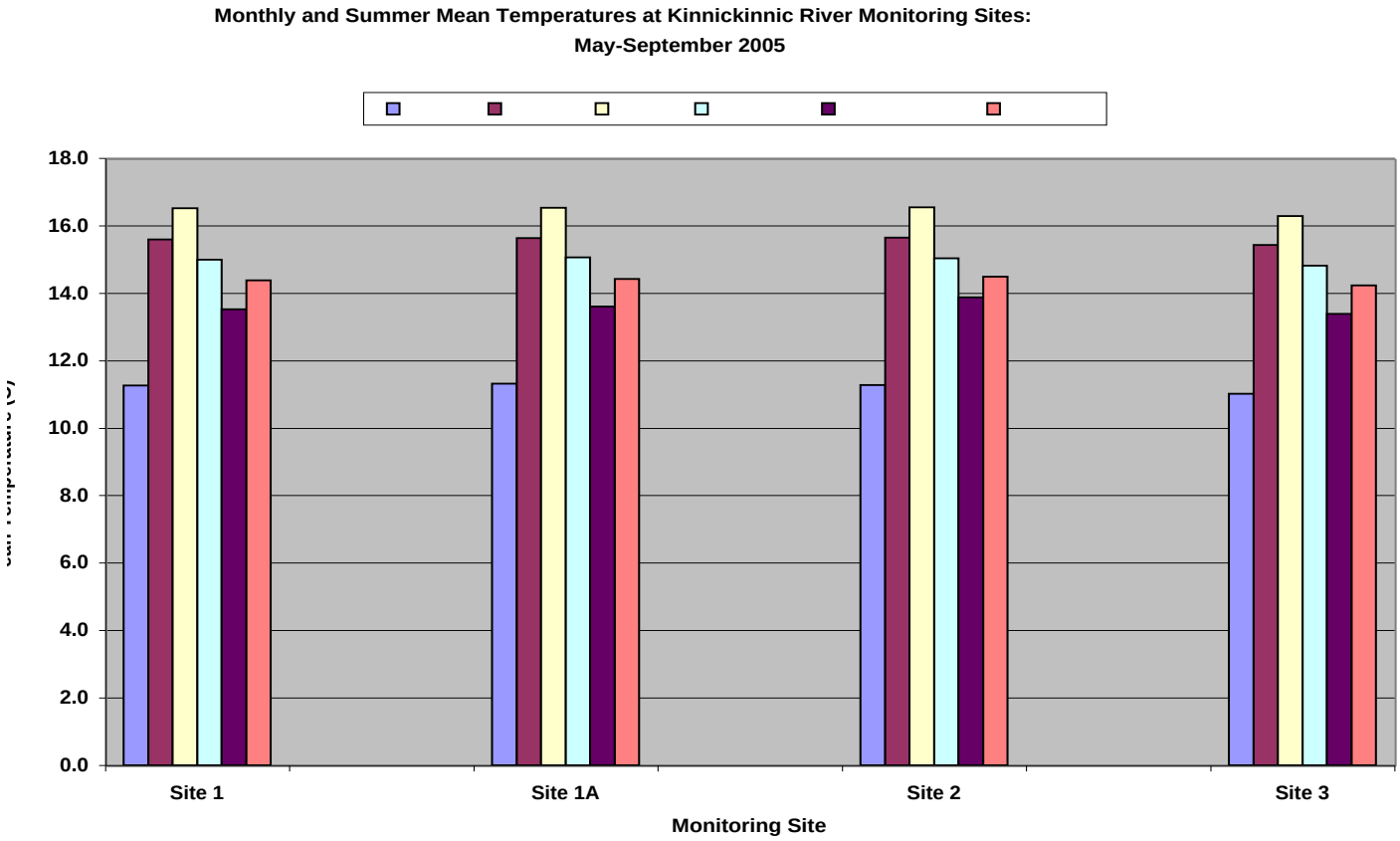
Kinnickinnic River Temperature Monitoring Results:

May-September 2005 (summer) temperature monitoring data were obtained for the Kinnickinnic River at Sites 1, 1A, 2, and 3. River temperatures at these four monitoring sites averaged 14.4° C and ranged from 4.5-21.5° C over the course of the summer. Slightly higher-than-normal river temperatures probably prevailed in the North Kinnickinnic River Monitoring Project Area during the summer of 2005, since the 2005 summer average air temperature of 19.7º C (67.4º F) was slightly higher than the normal summer average air temperature of 19.2° C (66.5° F).

Upstream summer temperatures at Sites 1A and 2 were nearly identical to downstream summer temperatures at Site 1. A comparison of temperatures at Site 1A (upstream) and Site 1 (downstream) is shown below.



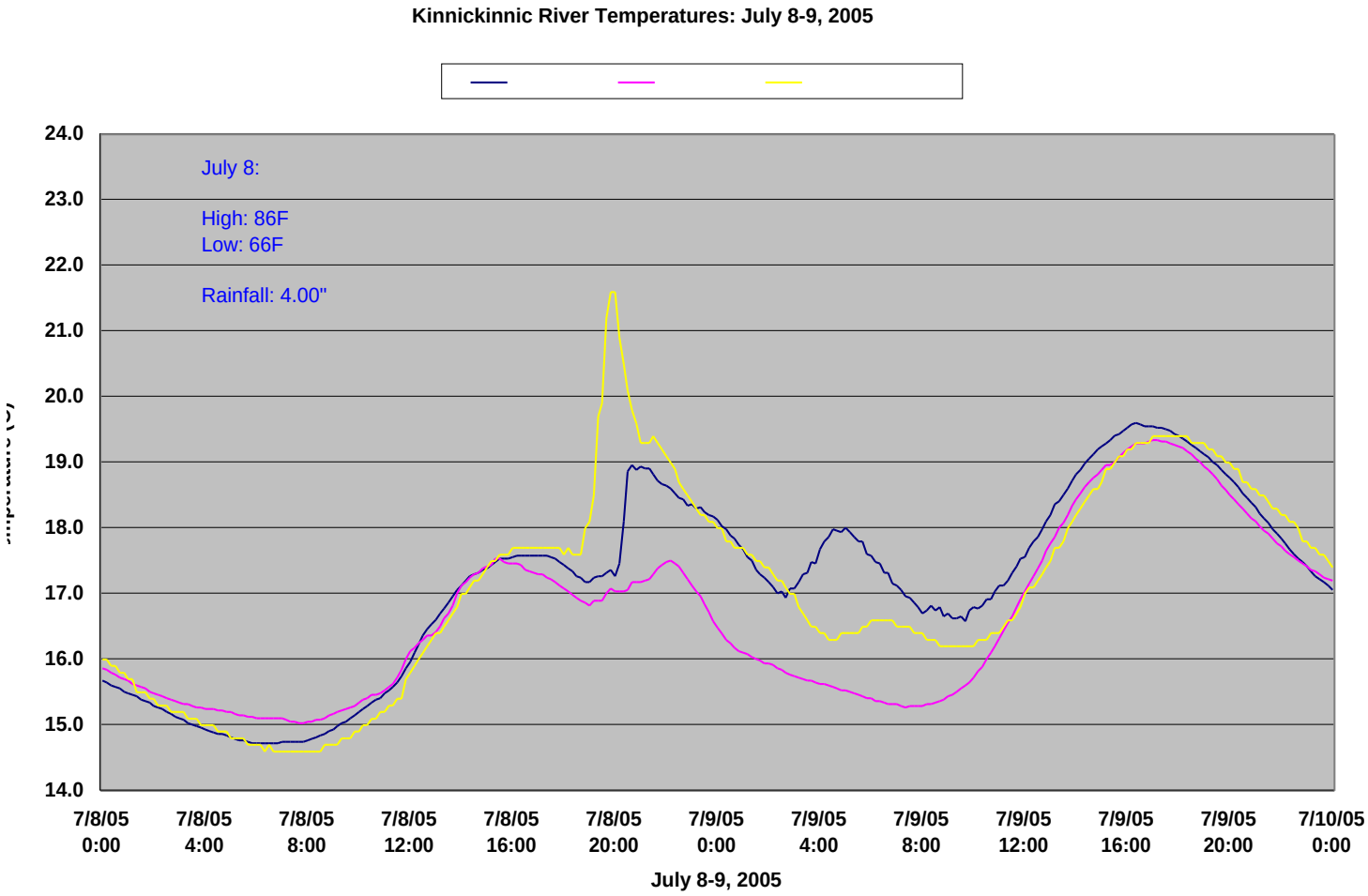
The monthly and summer average temperatures at Sites 1, 1A, 2, and 3 were also nearly identical, as shown below.



The summer 2005 temperature regime in the Kinnickinnic River at Sites 1, 1A, and 2 was excellent for coldwater macroinvertebrate and brown trout communities. Approximately 86% of all temperatures recorded at Sites 1, 1A, and 2 during the May-September 2005 period were less than or equal to (≤) 17° C, which is the top of the optimum temperature range for a healthy coldwater macroinvertebrate community. A temperature of 17° C is also considered to be the optimum for brown trout survival. Approximately 98% of all temperatures recorded at Sites 1, 1A, and 2 during the May-September 2005 period were ≤ 19° C, which is the top of the optimum temperature range for brown trout growth. Approximately 99.5% of all temperatures recorded at Sites 1, 1A, and 2 during the May-September 2005 period were ≤ 20° C, which is the top of the optimum temperature range for brown trout survival. River temperatures exceeding 20º C were only recorded on four dates in late June and mid-July, when air temperatures exceeded 32º C (90º F).

No storm water-related thermal impacts were apparent at Site 1 during five significant rainfall and runoff events in June, July, and September 2005. However, the largest rainfall event of the summer on July 8 (4.00 inches) produced two distinct thermal spikes at Site 1, downstream

from Sumner Creek and Sterling Ponds, as indicated below. As expected, a prominent thermal spike of 4.0º C also occurred at Division Street (below). The Sumner Creek and Sterling Ponds temperature monitoring results (below) help document the effectiveness of the City of River Falls Storm Water Management Ordinance in 2005, and also identify the cause of the thermal impact observed at Site 1 during the July 8 storm.



Sumner Creek and Sterling Ponds Temperature Monitoring Results:

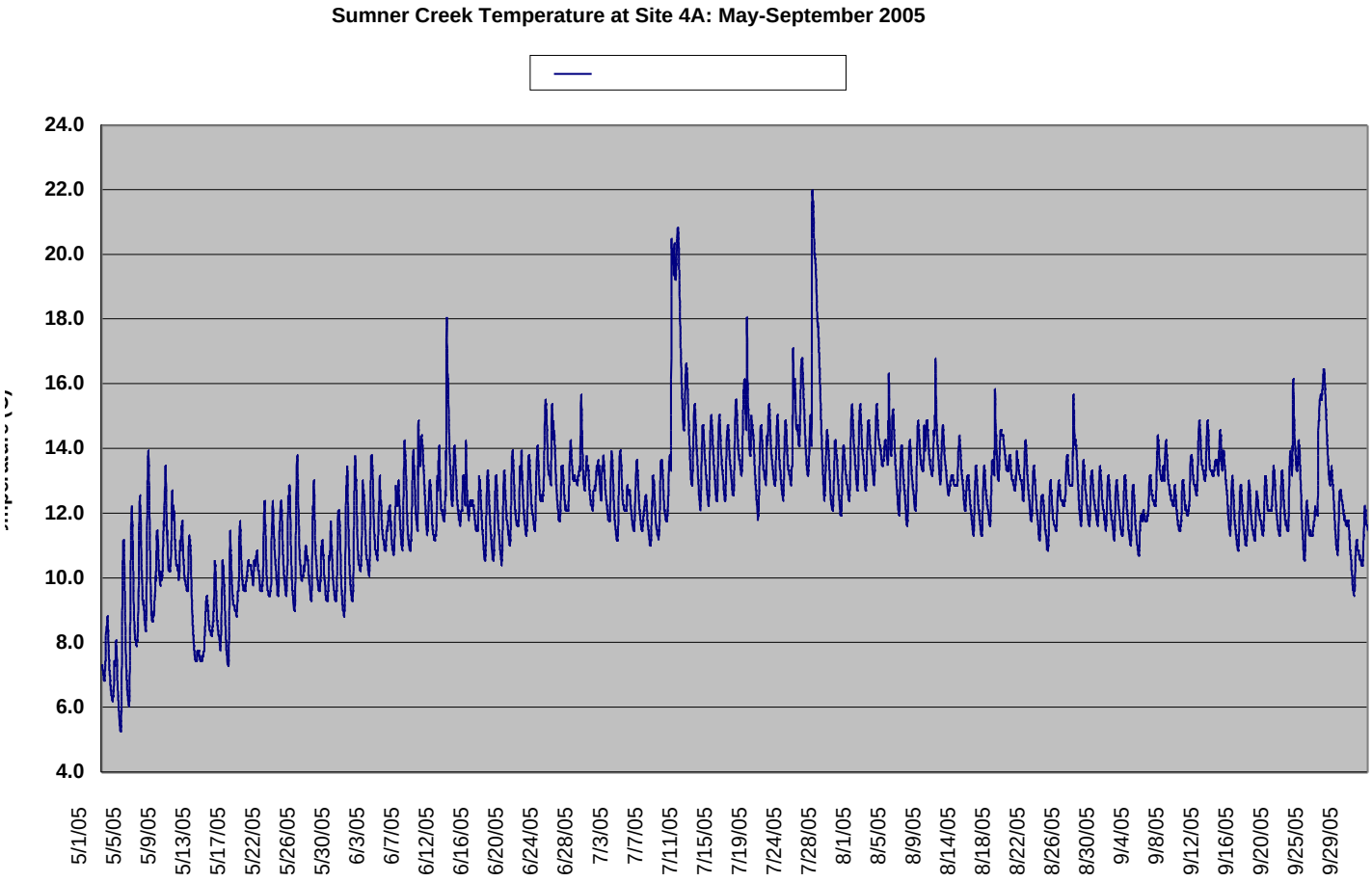
May-September 2005 (summer) temperature monitoring data were obtained for Sumner Creek at Site 6 (upstream from Sterling Ponds) and at Sites 4 and 4A (downstream from Sterling Ponds). Site 4A, near the mouth of Sumner Creek, was a new monitoring site in 2005. Temperature monitoring data for the Sterling Ponds storm water management practices were obtained in the wet detention pond (Site 5P), at the wet pond discharge to the infiltration basin (Site 5IB), and at the wet pond discharge to Sumner Creek (Site 5MH).

Temperature monitoring data indicate that the storm water management practices at Sterling Ponds caused no major thermal impacts on Sumner Creek

and the Kinnickinnic River during the May-September 2005 period. The summer mean temperature of the Sterling Ponds wet detention pond at Site 5P was 21.7º C, but much of this warm storm water was effectively discharged to the adjacent infiltration basin, as required by the River Falls Storm Water Management Ordinance. However, during all major rain events (in excess of one inch), warm storm water (17.9-27.2º C) from the wet detention pond was also discharged to the wetland area within the Sumner Creek drainage way. Due to water storage capacity in the wetland, these warm storm water discharges generally caused no downstream thermal impacts. However, after the largest rain event of the summer on July 8 (4.00 inches), a "plug" of warm water (including Sterling Ponds storm water) moved downstream from the wetland area, causing minor thermal spikes at Sites 4 and 4A in Sumner Creek and at Site 1 in the Kinnickinnic River.

Permanent flow occurred in lower Sumner Creek at Site 4A throughout the summer. The summer mean temperature (12.3º C) reflects strong spring flow, and the creek potentially provides a good thermal environment for a brook trout fishery. However, thermal spikes of significant magnitude (2.1-7.6º C) occurred at this location after numerous summer rain events in excess of 0.50 inch (see figure below). These spikes appear unrelated to the storm water discharges at Sterling Ponds, and seem to have a more local cause that needs further investigation.

With limited development in the Sterling Ponds subdivision in 2005, with some Sterling Ponds storm water management practices (erosion control measures, wet detention ponds, and a storm water infiltration basin) in place, and with Sumner Creek providing a lengthy buffer between the subdivision and the Kinnickinnic River, any Sterling Ponds storm water impacts on the river were projected to be minimal in 2005.



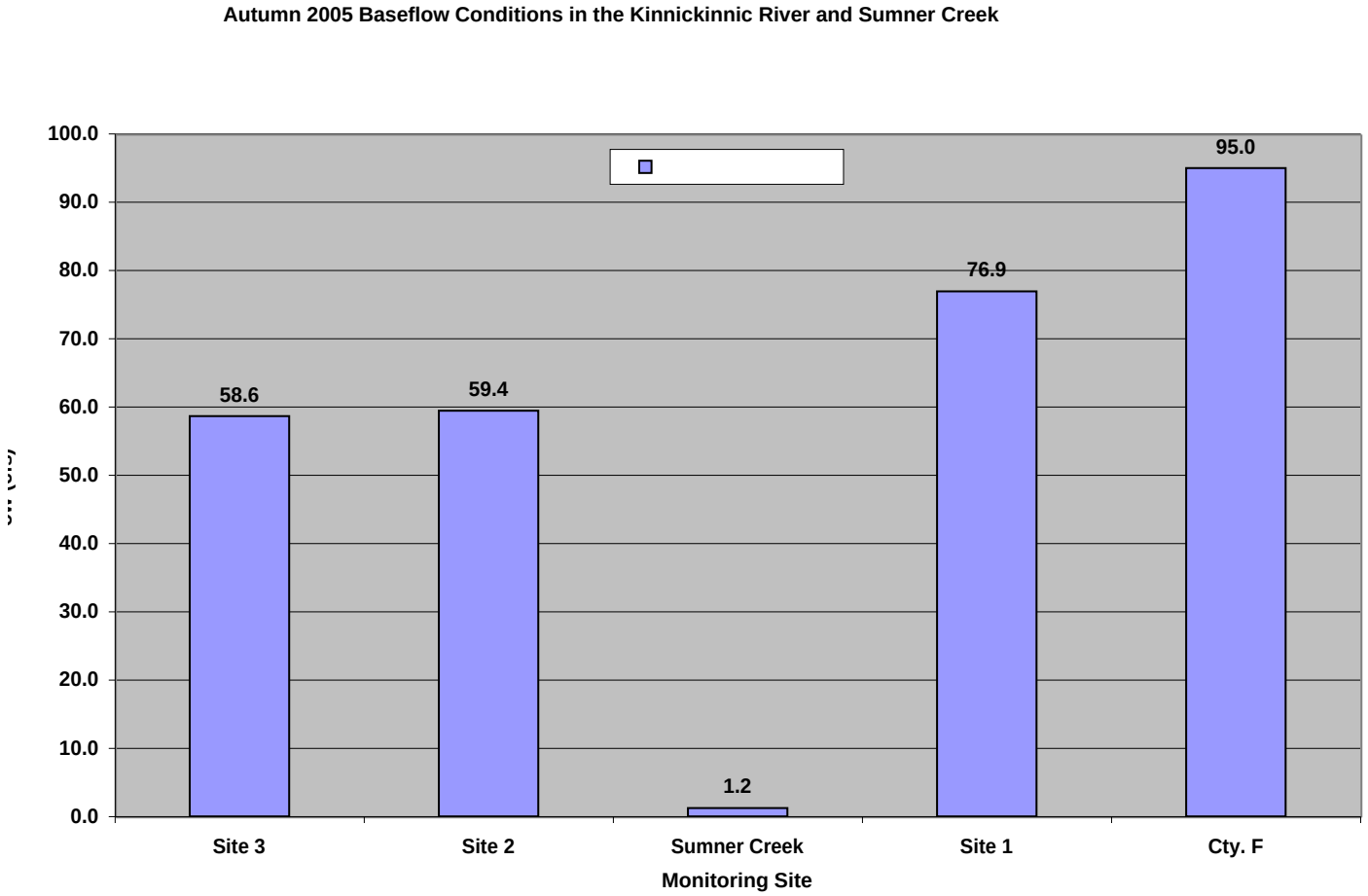
Base Flow Survey:

The USGS gauge located at County Highway F, as described in the technical report, was used to determine when a river base flow. When 3-4 days of "flat-line" flow was observed at this station, the river was assumed to be at a base flow condition. During dry periods between runoff events, the Kinnickinnic River maintained a base flow condition of approximately 80-90 cfs at County Highway F.

In the autumn of 2005, base flow measurements were obtained for the first time at Sites 1-3 in the Kinnickinnic River and at the mouth of Sumner Creek (Site 4A) within the North Kinnickinnic River Monitoring Project Area. The survey results are presented below. Base flows were very similar at Sites 2 and 3, but a 30% increase in base flow was evident at Site 1, with Sumner Creek contributing only a small proportion of this increase.

One goal of the River Falls Storm Water Management Ordinance is to maintain strong base flow conditions in the Kinnickinnic River by requiring storm water

management practices that promote infiltration of rainfall, thereby maintaining shallow aquifer levels, as well as the springs that provide cold water for the river. The initial base flow survey in 2005 will provide a baseline for determining if the present base flow condition will be sustained in the future as development progresses in the North Kinnickinnic River Monitoring Project Area.



Macroinvertebrate Monitoring:

Aquatic macroinvertebrates are excellent indicators of water quality, as they live in the stream environment for extended periods (up to a year or more), thereby reflecting past as well as present water quality conditions. In May 2005, macroinvertebrate samples were obtained from the Kinnickinnic River at Sites 1, 2, and 3. Organisms were identified and counted in the laboratory, and Hilsenhoff Biotic Index (HBI) values were then calculated for each monitoring site. The Hilsenhoff Biotic Index (HBI) is particularly useful for determining the influence of organic pollution on macroinvertebrates. This index has been used for many years by the Wisconsin Department of Natural Resources in long-term

stream monitoring efforts. Each HBI organism has been assigned a specific tolerance value, ranging from 1 (extremely intolerant of organic pollution) to 10 (extremely tolerant of organic pollution). The more intolerant macroinvertebrates that are present at a monitoring site, the lower the HBI value, indicating better water quality.

The 2005 Kinnickinnic River macroinvertebrate HBI values at Sites 1, 2, and 3 are presented below. HBI values at Sites 1 and 3 are indicative of excellent water quality, while the HBI value at Site 2 is indicative of very good water quality .

Kinnickinnic River Macroinvertebrate HBI Values: 2005