Executive Summary

This project follows up on the *Water Management Plan for the Kinnickinnic River and Its Tributaries* completed in 1995, and the *Lake George Management Plan* completed in 1996. The 1995 plan identified the reconfiguration of Lake George as a potential project to decrease thermal and other pollutant loads to the river, and to complement possible future efforts by the City to link the City center to the river corridor. The *Lake George Management Plan* recommended converting Lake George to an artificial wetland and stream channel. However, no modeling or scientific studies were completed to quantify the impacts on the river.

The purpose of this project was to develop an overall management strategy for that portion of the Upper Dam Minor Watershed of the Kinnickinnic River watershed, which includes downtown River Falls and Lake George. Two advisory groups helped provide guidance for this project. The first was the Technical Advisory Committee (TAC). These seven individuals serving on the TAC offered water management strategic and technical expertise in scoping and executing the technical analyses and identifying and evaluating the various management options.

The second group was the Stakeholders Committee, comprised of eleven members representing a range of interests in the community. They provided valuable guidance in developing the overall management strategy proposed in this plan. Appendix B of the main report lists participants of each advisory group. These groups held 14 meetings between March 2003 and December 2004 to guide the development of this strategy.

Part of this project involved developing modeling tools to quantify the impacts of various management alternatives. The development of two models helped provide the technical information to evaluate the impact of various alternatives. The CE-QUAL-W2 model for the river between Quarry Road and Rocky Branch Creek helps quantify the thermal impacts of various management alternatives, and the urban runoff model P-8 models total suspended solids loads to the river.

In addition to evaluating reconfiguration alternatives for Lake George, this project examined the 176-acre watershed that drains untreated runoff directly to the river from just above Division Street to the Lake George dam. This examination included an identification and evaluation of watershed treatment practices for possible implementation to help reduce total suspended solids and thermal loads to the river from existing developed areas.

Installing best management practices (BMPs) for several identified projects in the watershed would reduce thermal and total suspended solids loads to the river above Lake George. These projects generally emphasize pre-treating and infiltrating the first

flush of runoff carried by storm sewers that serve some of the larger, higher impervious sewersheds in the project area. Located at the lower end of the sewersheds that discharge to the river above Lake George, the projects are intended to fit on land already owned or controlled by the City. The locations of the projects, the sewersheds they would serve, and the type of BMP proposed are shown in Figure ES-1 on page 5.

However, there were a number of high priority sewersheds on the more highly impervious east side of the river for which cost-effective BMPs are not likely to be found given the existing land use patterns. This is mainly because these sewersheds support intensive land uses which back right up to the river and allow little room to install infiltration-oriented BMPs without interfering with those current uses.

In addition to end-of-the-pipe BMPs, it was strongly recommended that smaller scale best management practices such as rainwater gardens (Figure ES-2) to increase runoff infiltration from one or several lots or short street sections be employed in multiple locations throughout one or two targeted sewersheds. These types of practices are usually best suited to residential areas, especially if resident acceptance and cooperation are high.

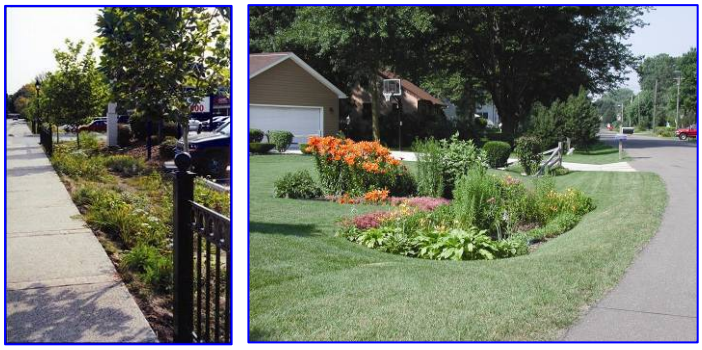

Figure ES-2: Rainwater Gardens Designed to Treat Impervious Area Runoff

The benefits of watershed BMPs in this system have limits, however. First, the watershed BMPs treat runoff from precipitation events. Thus, *watershed BMPs have no significant beneficial impact on baseflow temperatures in the river.* One significant concern is the warming of the system's river water under baseflow conditions during warm weather periods. This is mainly caused by warming of the river water as it passes through the downtown area and the reservoirs (Lake George and Lake Louise). This is an important factor because the baseflow condition is dominant during the summertime period.

A second important consideration is the effect of Lake George on watershed BMP-induced benefits showing up below that reservoir. *Thermal modeling completed for this project shows that thermal benefits of watershed BMP application in the project area above Lake George are virtually eliminated when passing the river water through Lake George in its current configuration*. Nonetheless, it was acknowledged that selectively implementing watershed improvements was desirable because of their overall beneficial impact in reducing the export of common urban pollutants to the river (TSS, heavy metals, phosphorus, etc.) and the likelihood that infiltration-oriented BMPs provide some incremental benefit in improving baseflow.

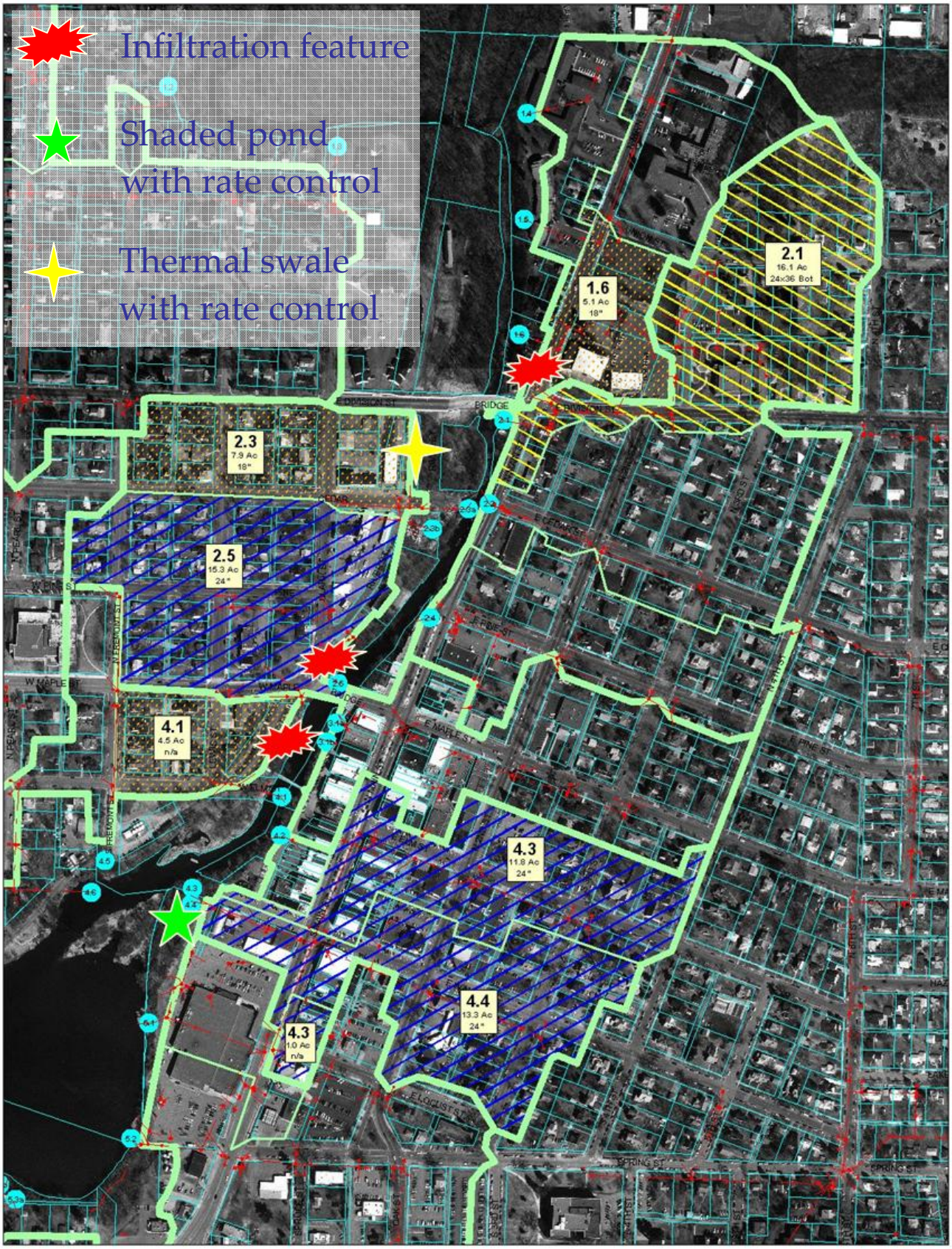

Figure ES-1: Location of Watershed BMP Opportunities

The second phase of this project looked at various options for reconfiguring Lake George itself. There was strong interest in making sure that any reconfiguration alternative selected has a demonstrable positive effect on thermal regimes in the river below Lake George dam under both baseflow and runoff conditions.

All options evaluated included an interceptor pipe extending north from Lake George upstream along the east side of the river as far as Division Street. The interceptor was supported because it can eliminate almost all the total suspended solids and thermal loads to the river above Lake George from the most highly impervious portion of the project area between Division Street and the lake. This raw runoff would be diverted by the interceptor to the Lake George area where the water could be treated and released in a controlled manner back to the river to minimize impact. The interceptor pipe could be capable of capturing runoff from up to 85% of the area of the highest priority sewersheds identified in this study.

After evaluating several alternatives, the reconfiguration alternatives shown in Figure ES-3 were selected as the preferred option. The main features of this alternative are as follows:

- A multi-cell configuration with the smaller northern-most cell to be used as the first (pretreatment) cell in the system to which raw stormwater from the interceptor system would be discharged. Access would be provided to facilitate periodic removal of accumulated sediment.
- Cells would be deepened to a maximum depth of 7-9 feet. Aquatic benches at no steeper than a 10:1 slope for at least 20 feet into each pond cell would be created to provide safety and to support fringe emergent growth. This is consistent with City standards for creating ponds.
- A thermal swale (yellow line) to carry discharge from the last cell of the reduced lake to the river. The cell could be shaded and/or underlain by a rock trench to further cool water discharged from the cell before discharging to the river.
- Piped connections between cells to convey water.
- A piped discharge between the last cell and the river with outlet controls. This pipe could be used to discharge water from the last cell to the river and would be constructed to reach the natural channel if the dam is removed.
- A channel to carry natural spring water (groundwater) discharges directly to the river without mixing with pond discharge water under most conditions. The location and viability of the springs is not known at this time, thus the location of this channel may need to be adjusted once the nature of the spring discharges is better defined.

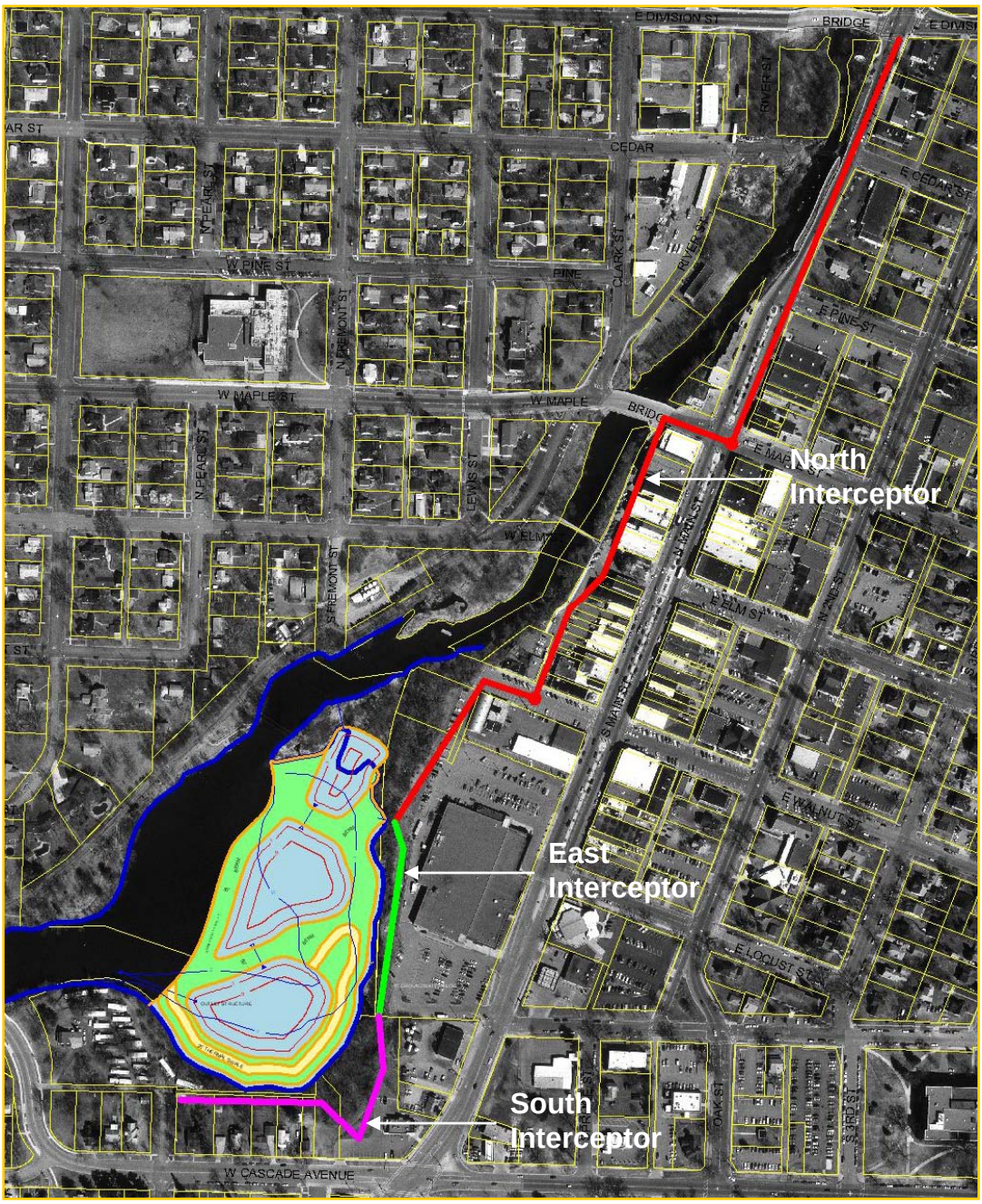

Figure ES-3: Recommended Lake George Reconfiguration Alternative and Local Stormwater Interceptor Pipes

Table ES1 summarizes the estimated benefits and costs of the preferred Lake George reconfiguration alternative along with the interceptor pipes needed to bring runoff from the downtown areas and the areas around Lake George to the upper end of the multi-cell system for treatment.

Table ES1: Summary of Costs for Recommended Lake George Reconfiguration Alternative and Interceptor Pipes

Alternative	Description	TSS and Thermal Benefits			Lake Reconfig Const. Cost	Downtown SS Diversion Const. Cost	Comments
		TSS Red. Benefit [1]	Thermal Benefit [2]				
		Reduction	Baseflow	Runoff Events			
Preferred Alternative	Divert downtown sewersheds, construct primary berm to separate lake from river and multiple internal berms for multi-cell treatment system, add thermal swale as low flow outlet and spring outflow conveyance channel	60-70%	Up to 1° C	<0.5° C w/o watershed improve-ments to 0.5° – 1°C with Priority 1 watershed improve-ments	$515,000 - $1,012,000	North Interceptor $944,000 – 1,200,000 LG East Interceptor $184,000 – 247,000 LG South Interceptor $212,000 – 289,000	Modeled thermal benefits account for rate control of outflows from modified Lake George, do not account for potential benefits of thermal swale, reduced surface area of Lake George

1 *Estimated at point of discharge to River*

2 *Estimated at location immediately downstream of Lake George*

On December 16, 2004, a combined meeting of the TAC and the Stakeholders Committee was held to review all information and provide recommendations to the City on an overall strategy. There was consensus that a multi-pronged approach involving strategic execution of both end-of-the pipe and small scale/small site watershed management actions, as well as reconfiguring Lake George and implementing a phased construction of interceptor pipes along the east side of the river was the best strategy to follow.

The critical elements endorsed by the TAC and Stakeholders Committee are as follows:

- Reconfigure Lake George into a multi-cell system separated from the river during baseflow and small to moderate runoff events.
- Construct the east interceptor (which includes capturing runoff from Econo Foods) as well as the first phase of the north interceptor up to Walnut Street.
- Extend the north interceptor as opportunities arise, such as during downtown redevelopment projects or road/alley reconstruction.
- Construct one or more "end-of-pipe" projects designed to infiltrate runoff on existing City-owned land, such as in Heritage Park on the west side of the river.
- Concentrate on one to several storm drainage sewersheds to work with private property owners to find suitable sites for, and install, small scale stormwater treatment features such as rainwater gardens. These efforts could focus on parts of the study area where diverting runoff to a reconfigured Lake George for treatment is not feasible, end-of-the-pipe treatment strategies may not be practical, or neighborhood interest and cooperation may be very high.
- Develop and execute a public education program aimed at building understanding of and support for the overall management strategy and its various components among the general public as well as the business community.

It was also recognized that there are still important actions that need to be undertaken before the concept for the Lake George reconfiguration can be finalized and design completed. The main issues are:

- Collecting reliable bathymetric information on the existing lake
- Locating possible natural spring groundwater discharges to the lake
- Assessing in greater detail the engineering properties of the sediment within the lake
- Beginning the process of identifying and developing the information needed to secure regulatory permits, especially those necessary to work in the bed of the river at Lake George
- Investigating flowage rights and underlying ownership of the lake
- Identifying possible funding sources for implementation