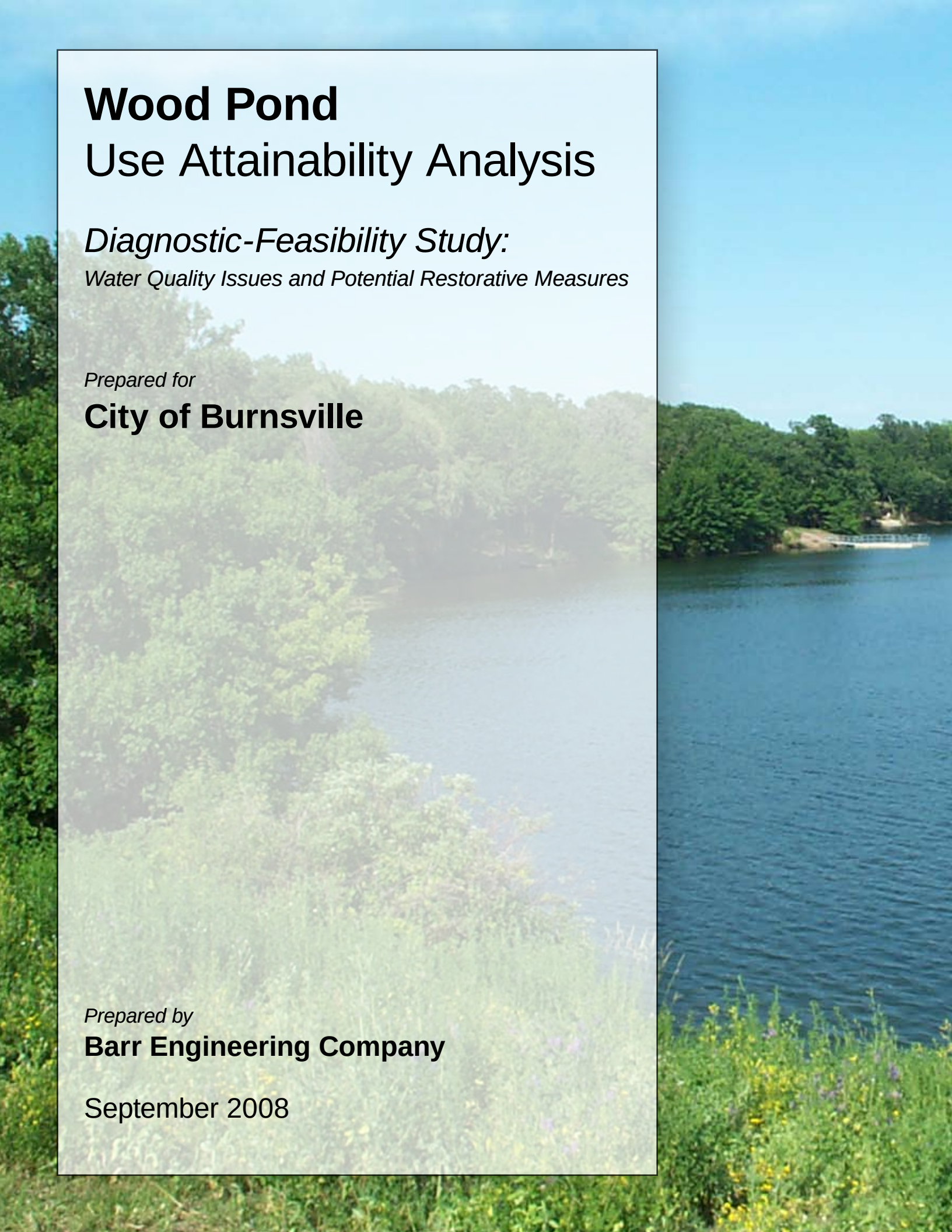

Wood Pond
Use Attainability Analysis

Diagnostic-Feasibility Study:
Water Quality Issues and Potential Restorative Measures

Prepared for
City of Burnsville

Prepared by
Barr Engineering Company

September 2008

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BARR

4700 West 77th Street
Minneapolis, MN 55435-4803
Phone: (952) 832-2600
Fax: (952) 832-2601

Executive Summary

This report describes the results of the Use Attainability Analysis (UAA) for Wood Pond in Burnsville, MN. This UAA provides the scientific foundation for a lake-specific best management plan that will permit maintenance of, or attainment of, intended beneficial uses of Wood Pond. The UAA is a scientific assessment of a water body's physical, chemical, and biological condition.

This study includes both a water quality assessment and prescription of protective and/or remedial measures for Wood Pond and its watershed. The conclusions and recommendations are based on historical water quality data, the results of an intensive lake water quality monitoring program in 2007, and computer simulations of land use impacts on water quality in Wood Pond using a watershed runoff model and lake models calibrated to 2001, 2002, 2006 and 2007 lake monitoring data. In addition, best management practices (BMPs) were evaluated to compare their relative effect on total phosphorus concentrations and Secchi disc transparencies (i.e., water clarity). Management options were then assessed to determine attainment or non-attainment with the lake's beneficial uses.

A *Wood Pond Use Attainability Analysis Project Synopsis* was presented to local residents on May 28, 2008. The project synopsis discusses the water quality problems in Wood Pond and the related causes, the investigative techniques used in the UAA process, and the recommended management strategy for improving the water quality.

Examination of available water quality monitoring data indicate that Wood Pond currently does not consistently meet the City's summer-average Secchi disc transparency goal of 1.7 meters, which was set forth in Burnsville's 2002 *Water Resources Management Plan*. Implementation of the BMPs recommended for the lake and its watershed would, on average, allow Wood Pond to meet the City's transparency goal (1.7 meters), based on modeling predictions for wet, dry, and average precipitation conditions (see Section 5.3 for a more detailed description of this methodology). However, due to natural variability in climatic conditions and in-lake processes, Wood Pond may not meet the City's water clarity goal every year.

Wood Pond Use Attainability Analysis

Project Synopsis

A Use Attainability Analysis (UAA) is a scientific assessment of a water body's physical, chemical, and biological conditions. It uses an outcome-based evaluation and planning process in order to obtain or maintain optimal water quality conditions and achieve beneficial uses, such as swimming, fishing, or wildlife habitat.

During 2007–2008, the City of Burnsville conducted a UAA for Wood Pond to address current water quality issues. The UAA includes a water quality analysis and prescription of protective measures for Wood Pond and the watershed based on historical water quality data, the results of intensive lake water quality monitoring, and computer simulations of land use impacts on water quality.

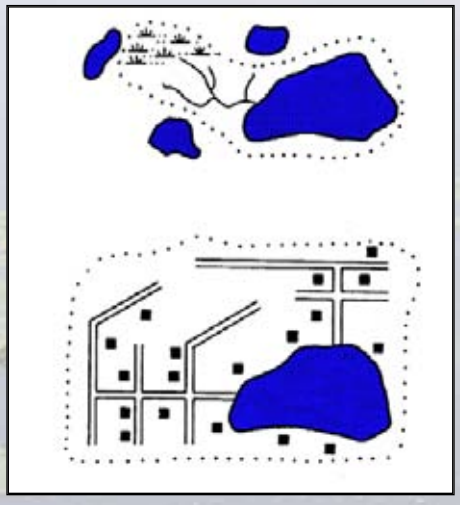
Typical Urban Lake Water Quality Problems

The primary problem in urban lakes is "cultural eutrophication," which is defined as the accelerated increase in concentrations of nutrients, primarily phosphorus and nitrogen, in a lake as a result of human activities in the watershed. Eutrophication is often indicated by increased algal growth, decreased water clarity, and loss of dissolved oxygen in the bottom waters of the lake, which leads to a shift in fish species from desirable game fish to non-game species such as carp and bullhead.

Nuisance algae in lakes results from the excess phosphorus that reaches lakes due to increased stormwater runoff.

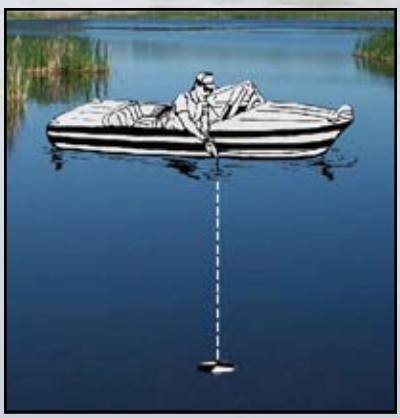
The Usual Suspects

These problems typically occur because of watershed urbanization and nonpoint source pollution. Increased urbanization in a watershed leads to more streets, driveways, and rooftops (impervious surfaces). This increased imperviousness results in more stormwater runoff traveling quickly through storm sewers, diminishing the runoff pollutant retention capacity of natural, undisturbed landscapes. The increased stormwater runoff carries excess nutrients into lakes and streams as nonpoint source pollution. Increased concentrations of phosphorus in lake waters is the leading cause of algal blooms and decreased water clarity.



Source: Monson (1992)

Before development (top image), stormwater travels slowly through a watershed. After development (bottom image), impervious surfaces are increased, resulting in more stormwater runoff and less filtration of nutrients.



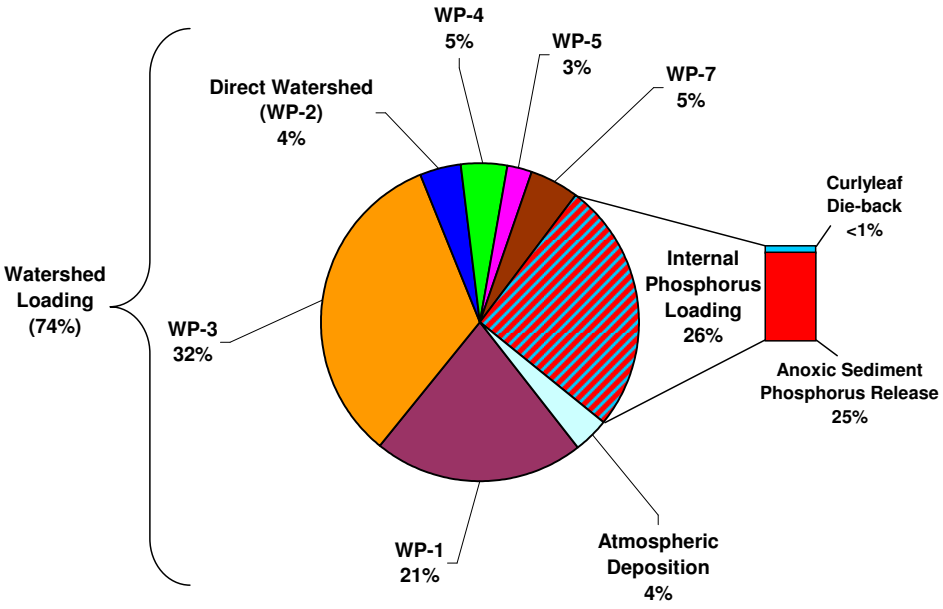
A lake's clarity (transparency) is measured by submerging a black and white patterned disc (a Secchi disc) into the lake. The depth at which the Secchi disc disappears determines the lake's transparency.

City of BURNSVILLE

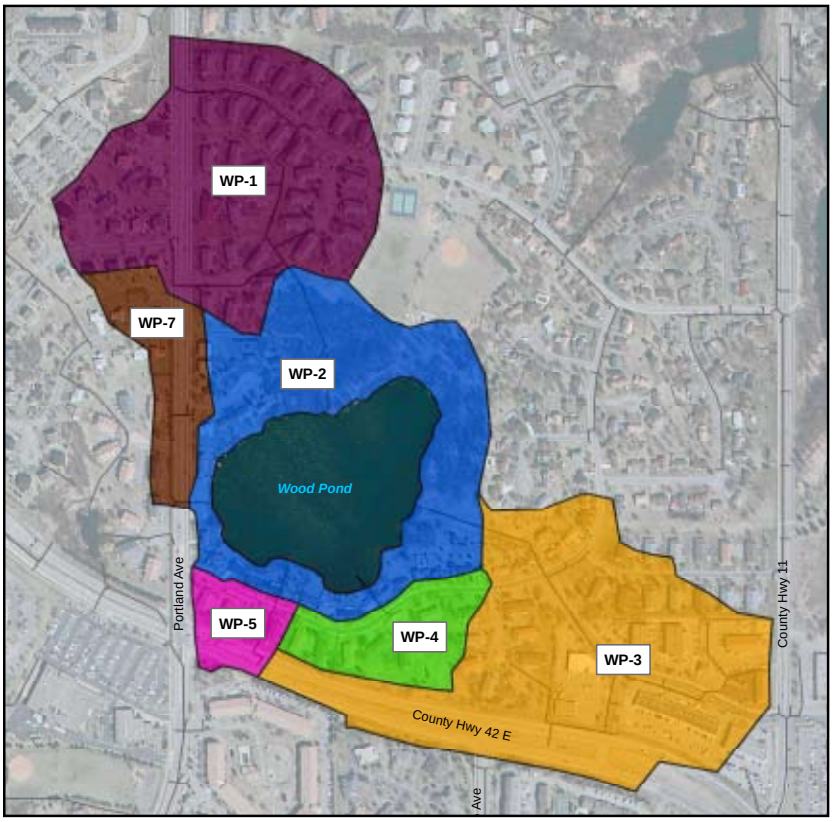
Wood Pond Water Quality Problems and Causes

The water quality assessment portion of the UAA determined that Wood Pond suffers from summer algal blooms caused by high phosphorus levels in the lake. The water quality assessment portion of the UAA determined that the phosphorus loading to Wood Pond comes from two primary sources: poor quality urban stormwater runoff (external loading) and internal loading due to release of phosphorus from the lake sediments. The following page explains the recommended water management strategy for handling these problems.

Wood Pond Annual Phosphorus Budget (84 lbs)
Model Calibration Year (2007) Using Existing Land Use



The UAA includes data such as the pie chart above, which shows the breakdown of sources of the annual phosphorus load to Wood Pond based on the model calibration year (2007). See the map below to cross-reference the source/location codes. The fraction of annual phosphorus loading from internal and external sources will vary from year to year based on varying precipitation patterns.



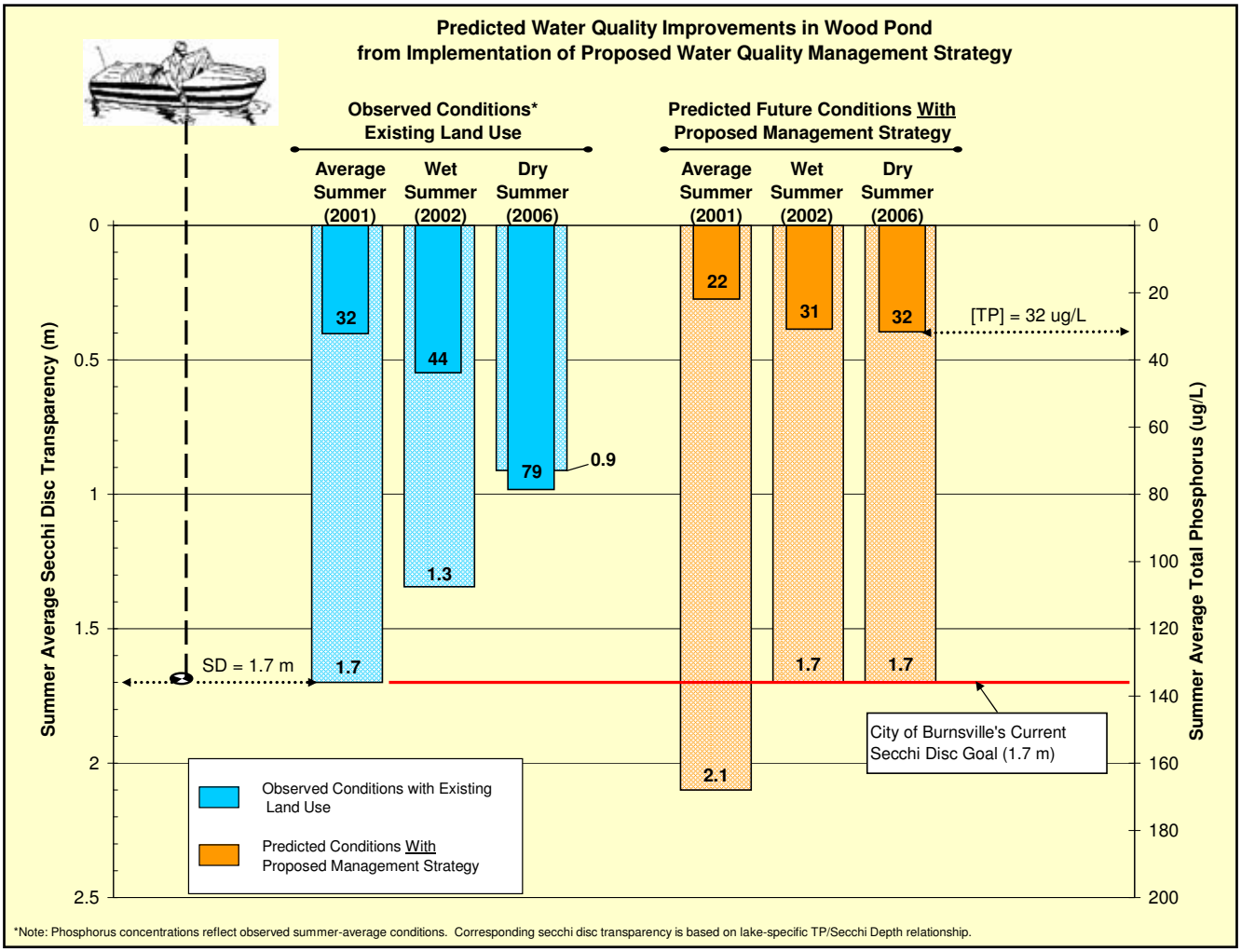
Investigative Techniques Used in UAA Process

The Wood Pond UAA includes both a water quality analysis and prescription of protective measures for Wood Pond and its watershed. This analysis and prescription is based on:

- Historical water quality data
- Aquatic plant surveys
- Intensive lakewater quality study
- P8 computer simulation modeling of runoff water quality
- Lake hydrologic and phosphorus budget analyses
- Best management practices (BMPs) analysis

Recommended Management Strategy for Wood Pond

The following figure and table summarize the recommended management strategy for Wood Pond. Several strategies were evaluated based on effectiveness, cost, and feasibility. Input was gathered from the city staff and neighborhood residents as part of the evaluation process. The figure shows current and predicted water quality conditions, both with and without implementation of recommended water quality improvement projects. The table lists elements of the recommended strategy and its cost.



Water Quality Management Strategy Elements[1]	Estimated Capital Cost[2] (2008 Dollars)	Annual Operation & Maintenance Cost (2008 Dollars)
Watershed Loading Reduction Efforts		
Construct Water Quality Pond to Treat Runoff from Subwatershed WP-1	$230,000	$6,000
Construct Rainwater Garden in Residential Area of Subwatershed WP-3	$110,000	$2,000
Construct Subsurface Infiltration System Below Roadway of Subwatershed WP-4	$115,000	$6,000
In-Lake Chemical Treatment		
In-Lake Alum Treatment of Wood Pond	$35,000	-
Total	**$490,000**	**$14,000**

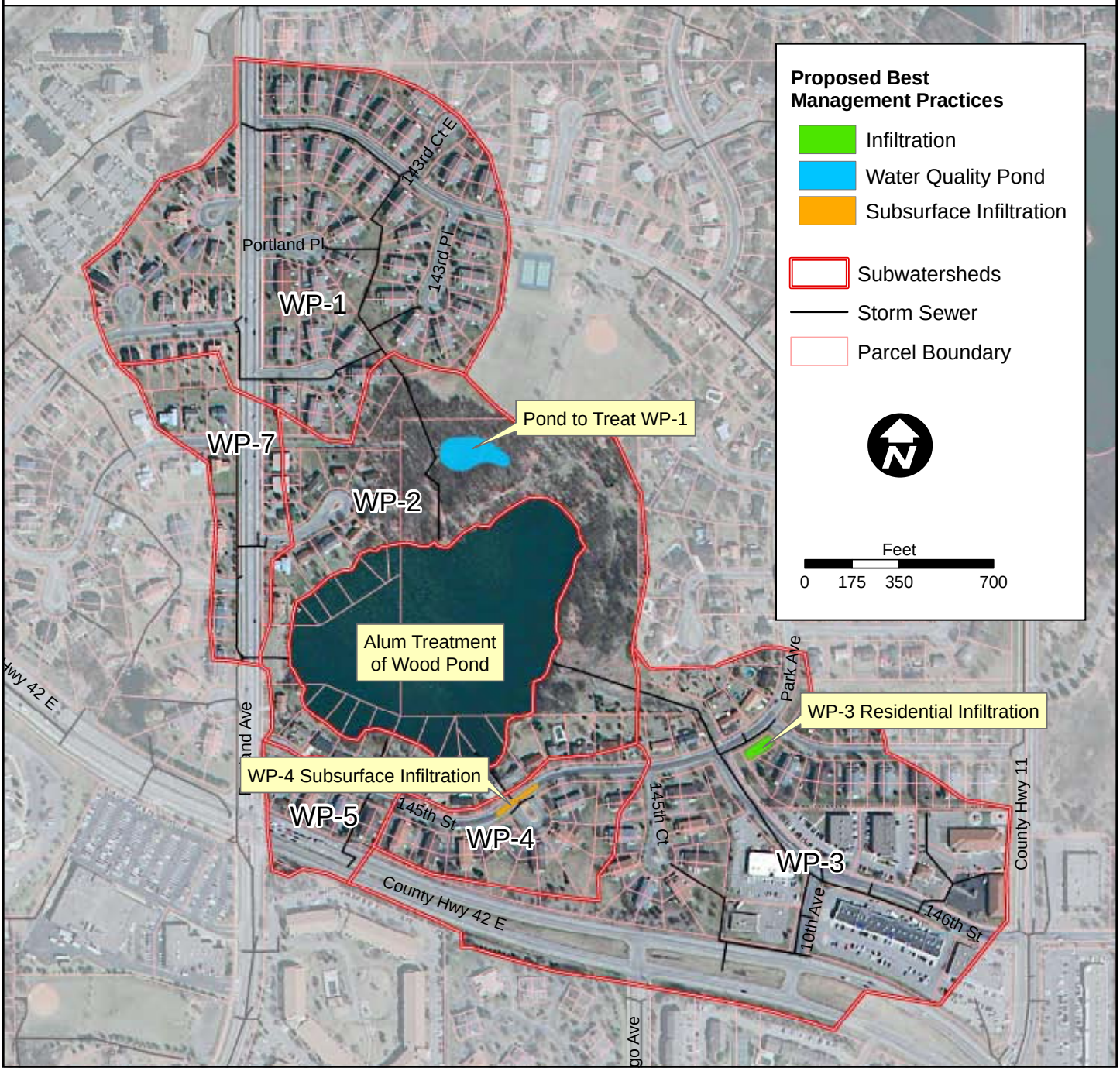
[1] The map on page 4 illustrates the approximate locations of the proposed water quality management strategy elements.

[2] Estimated capital costs include contingency (10%) and estimated engineering fees (28%).

Location of Recommended Management Strategy Elements

This map shows the location of the recommended lake water management strategy elements for improving the water quality of Wood Pond.

Proposed Water Quality Improvement Sites
Wood Pond Watershed
City of Burnsville



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