

Lake Owasso Use Attainability Analysis

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

Prepared for: GLWMO

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Urban Lake Water Quality Problems

- The Problem

- Cultural Eutrophication:

- “The accelerated increase in concentrations of nutrients, primarily phosphorus and nitrogen, in a lake as a result of human activities in the watershed



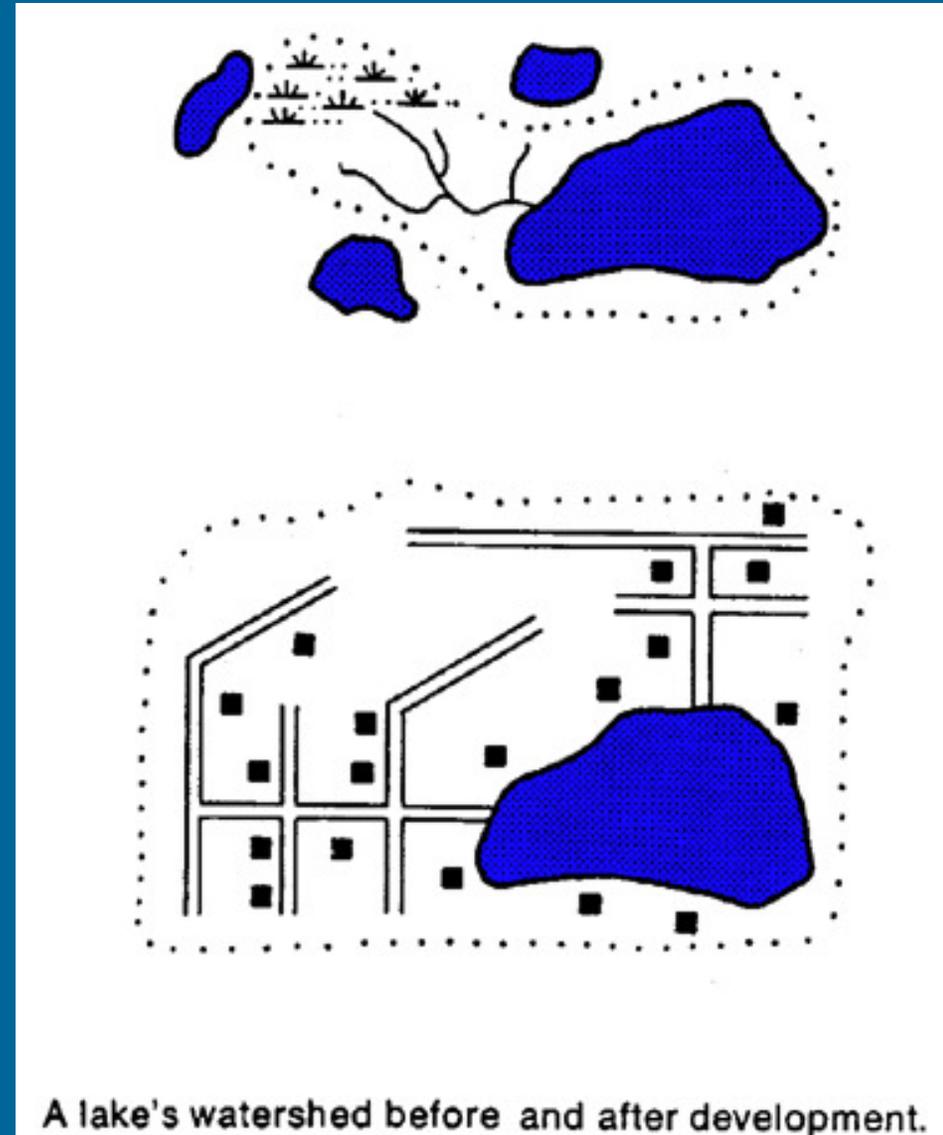
- Symptoms

- Increased algal growth
 - Decreased water transparency
 - Loss of dissolved oxygen in water near the lake bottom
 - Shift in fish species from gamefish (bass & walleye) to non-game fish species tolerant of low oxygen levels (carp & bullheads)



Urban Lake Water Quality Problems

- Causes/Sources
 - Watershed urbanization and nonpoint source pollution
 - Increased watershed imperviousness
 - Increased runoff collection system efficiency (via stormsewers)
 - Decreased pollutant retention capacity of watershed ponds and wetlands
 - Results
 - Increased runoff volumes and rates
 - Increased pollutant wash-off to receiving waters (lakes)

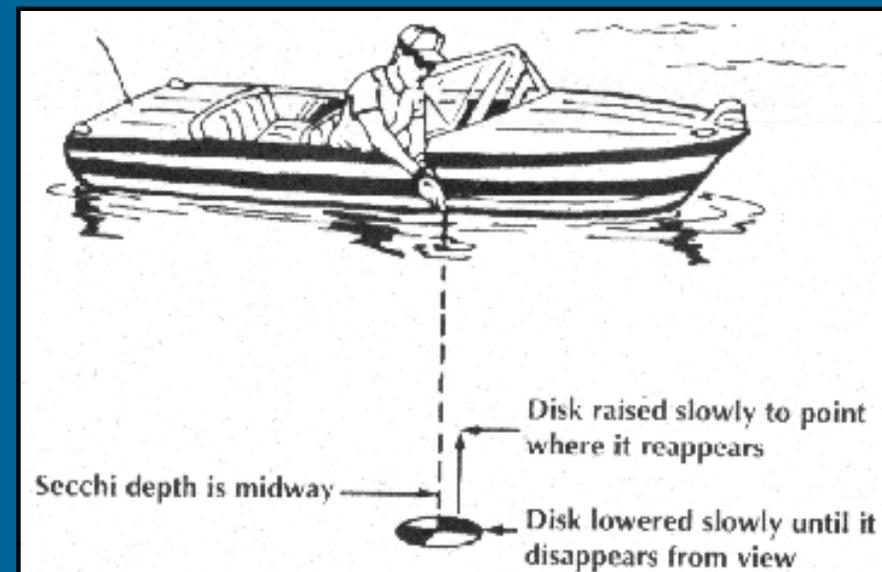
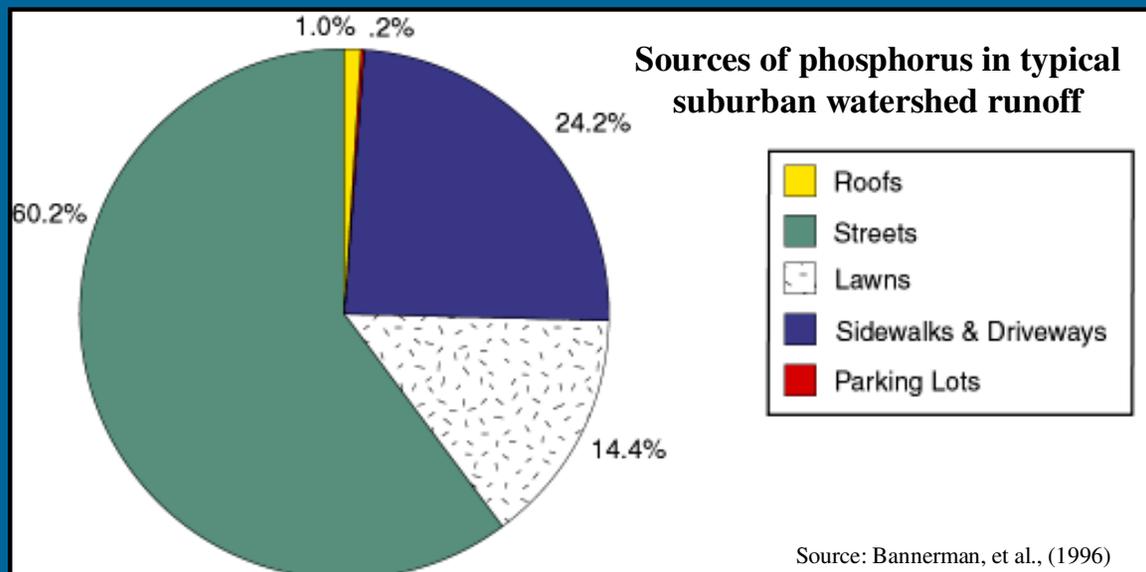


A lake's watershed before and after development.



Urban Lake Water Quality Problems

- “The Limiting Nutrient”
 - Phosphorus - phosphorus generally controls the growth of algae in lake systems and it is usually the limiting nutrient for biological growth
 - Increased phosphorus concentrations in lake waters results in more algae and as a result less water transparency (Secchi disc visibility - the depth at which a nine-inch diameter, black-and-white patterned disc disappears from view when lowered into the lake)



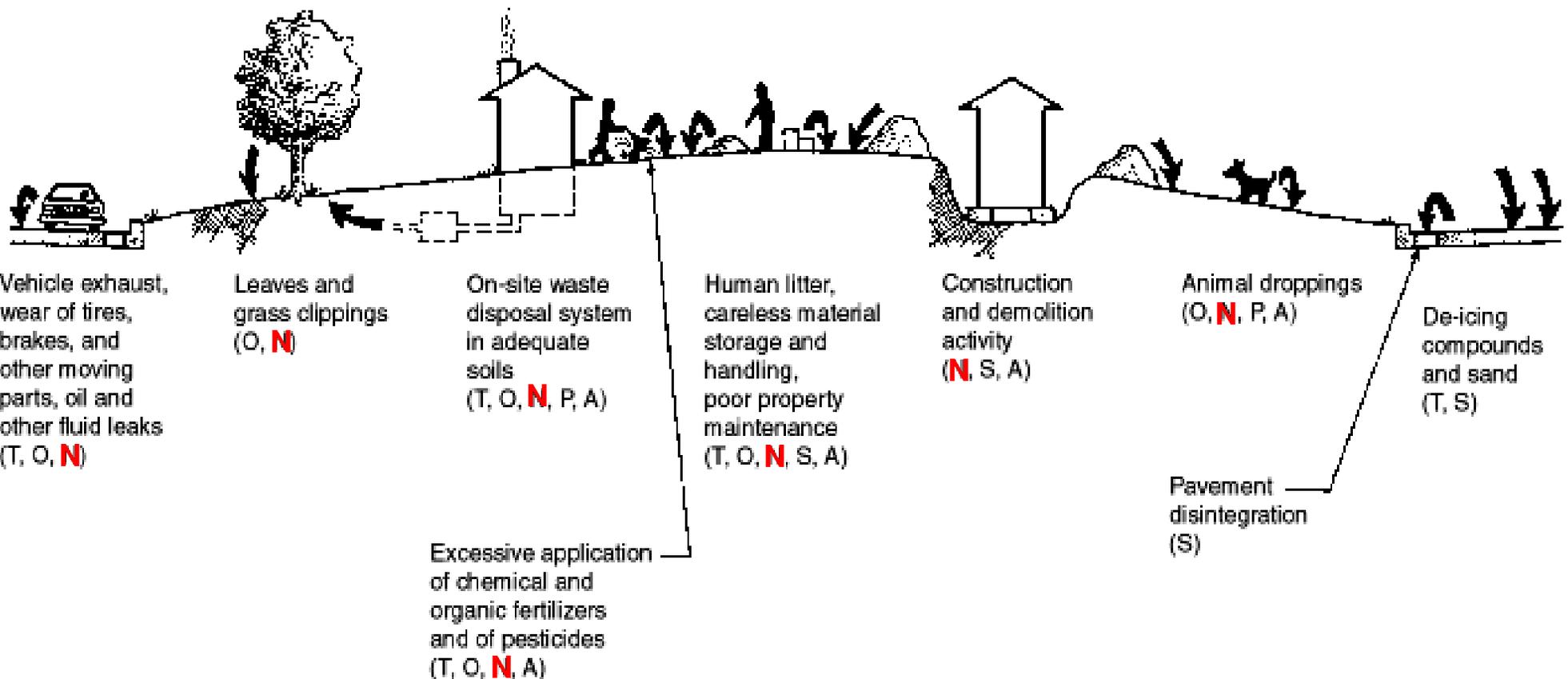
AVAILABILITY OF POTENTIAL POLLUTANTS ON THE URBAN LAND SURFACE

LEGEND

Types of pollutants that may occur in or near the urban area as a result of the indicated activity

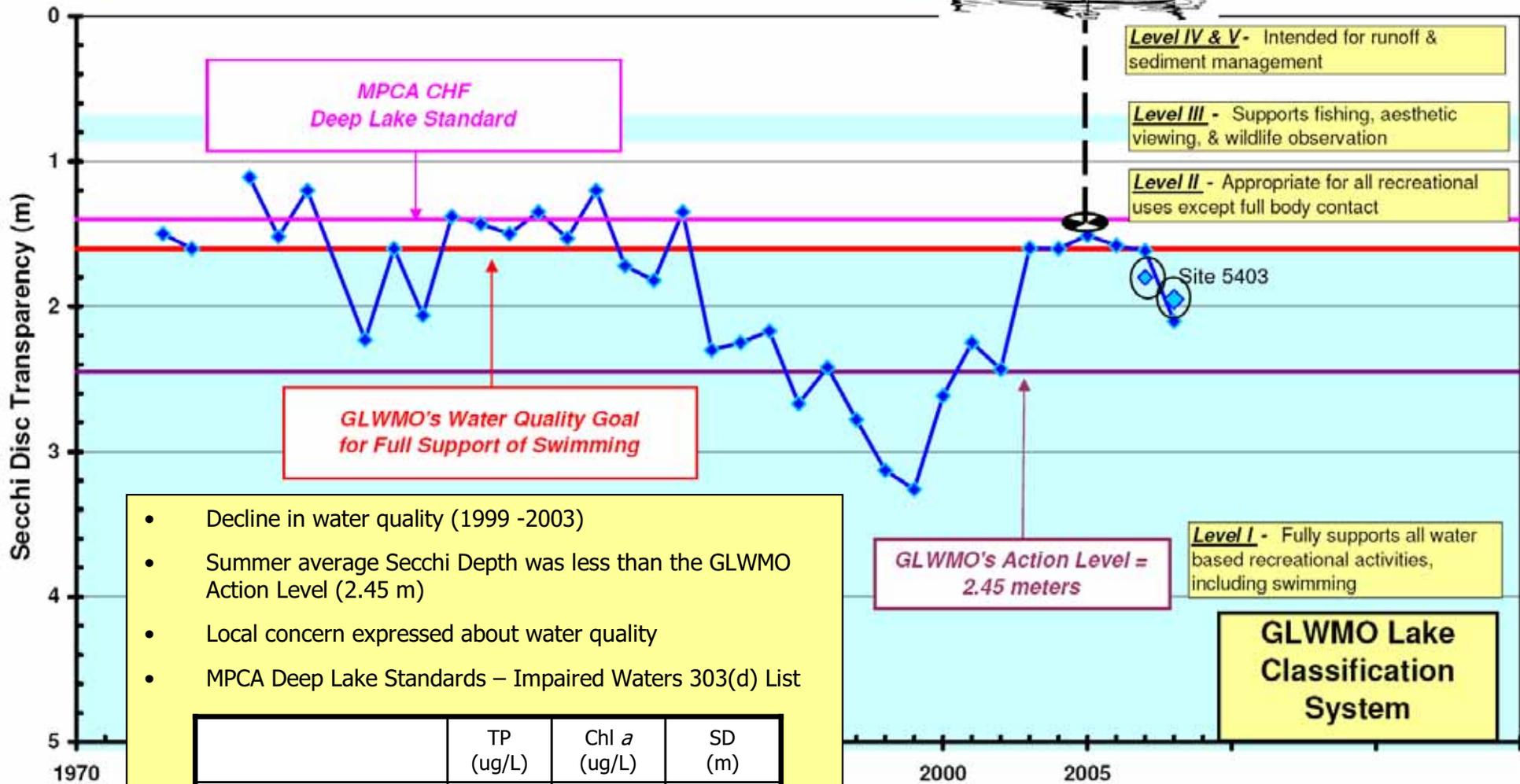
T...Toxic
O...Organic
(Oxygen Demanding)
N...Nutrient
(N and P, primarily)
P...Pathogenic
S...Sediment
A...Aesthetic

Atmospheric Washout and
Dry Fallout (T, N, S)



Reason for Current Study

Lake Owasso
Historical Summer-Average Secchi Disc Transparencies
(Late-May through Early-September)



- Decline in water quality (1999 -2003)
- Summer average Secchi Depth was less than the GLWMO Action Level (2.45 m)
- Local concern expressed about water quality
- MPCA Deep Lake Standards – Impaired Waters 303(d) List

	TP (ug/L)	Chl <i>a</i> (ug/L)	SD (m)
2008 Summer Avg	32	13	2.1
10-year Summer Avg	38	15.6	2.1
MPCA Deep Lake Stds	40	14	1.4



Use Attainability Analysis

- Structured scientific assessment of a water body's physical, chemical, and biological conditions.
- Provides a scientific foundation for a lake-specific management plan that will permit maintenance of existing or attainment of intended beneficial uses.
- “Use attainment” refers to designated beneficial uses such as recreation, fishing, and wildlife



7 Steps of a Lake Use Attainability Analysis

1. Determine current and historic water quality conditions
2. Set beneficial use goals
3. Assess current watershed land use condition attainment or nonattainment of the goals
4. Estimate annual hydrologic and phosphorus budgets for the lake
5. Reconcile the budgets to observed in-lake conditions using a lake water quality model



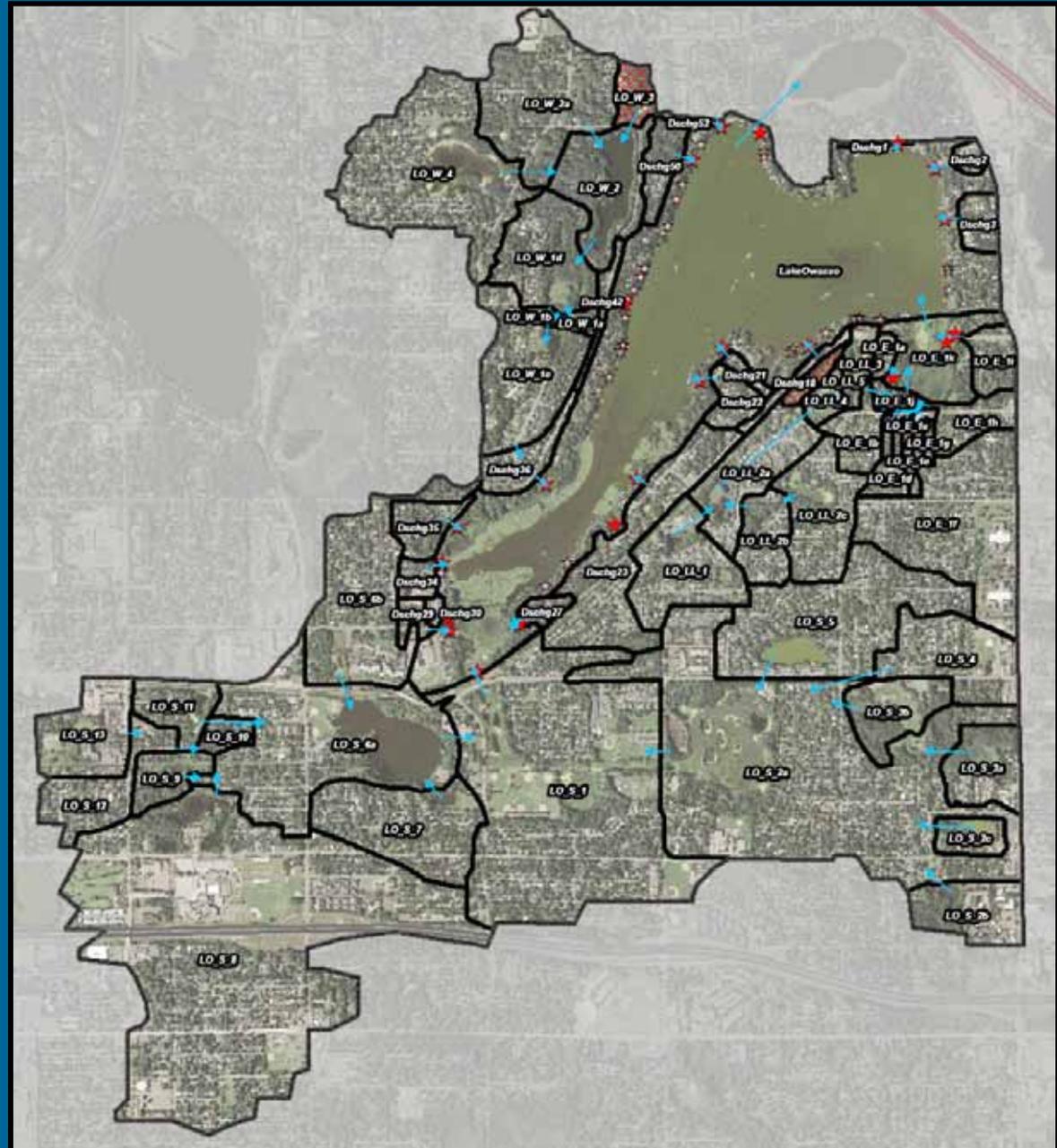
7 Steps of a Lake Use Attainability Analysis

6. Using the lake model calibrated to current conditions, assess the likelihood of beneficial use attainment under ultimate (future) watershed land use conditions
7. If nonattainment is predicted for ultimate development conditions, recommend feasible alternative remedial measures



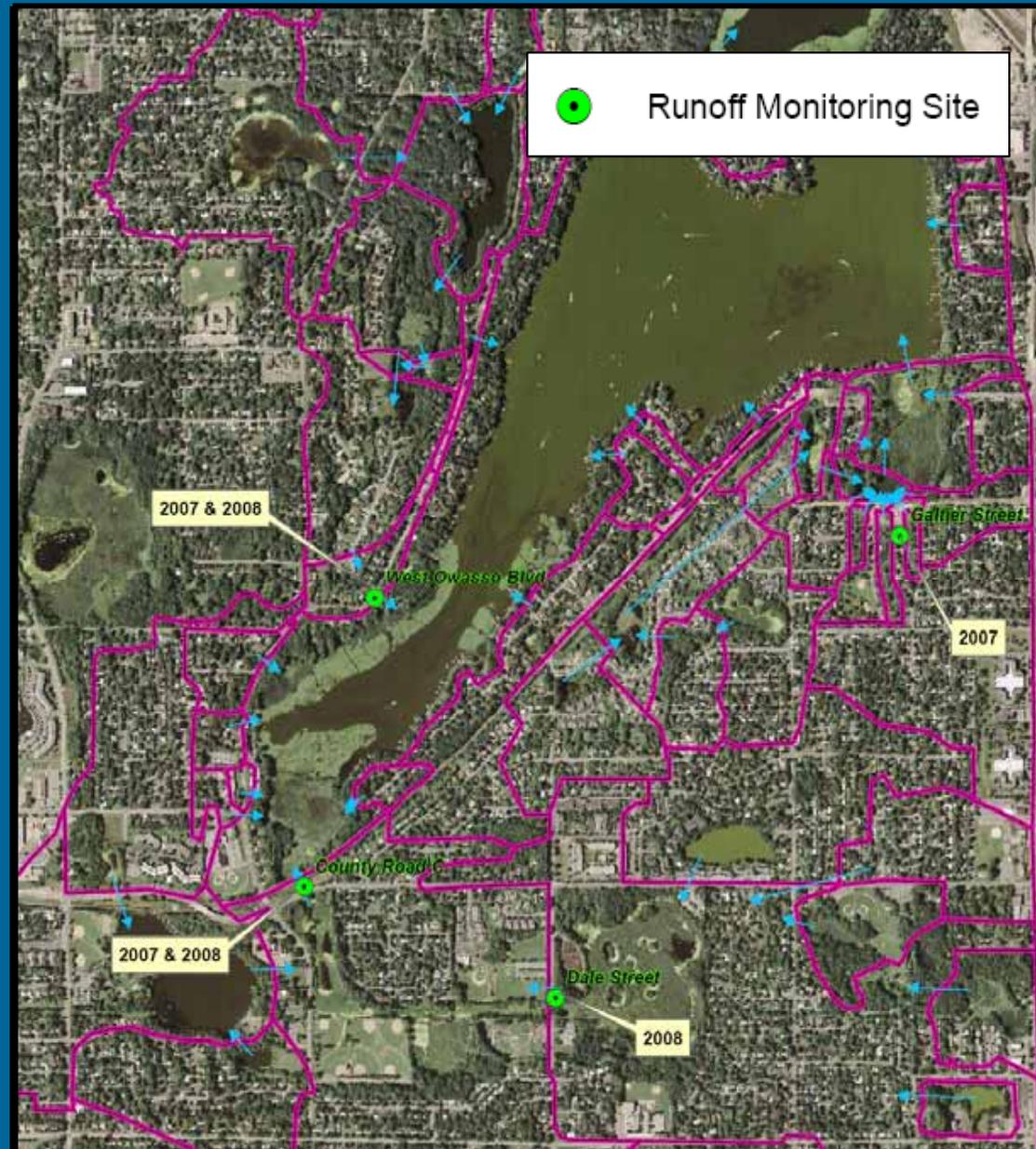
Lake Owasso Fun Facts

- Lake Area = 375 acres
- Max Lake Depth = 37 feet
- Watershed Area = 3,060 acres
 - Mostly Residential Land Use with Open Water and Wetlands throughout



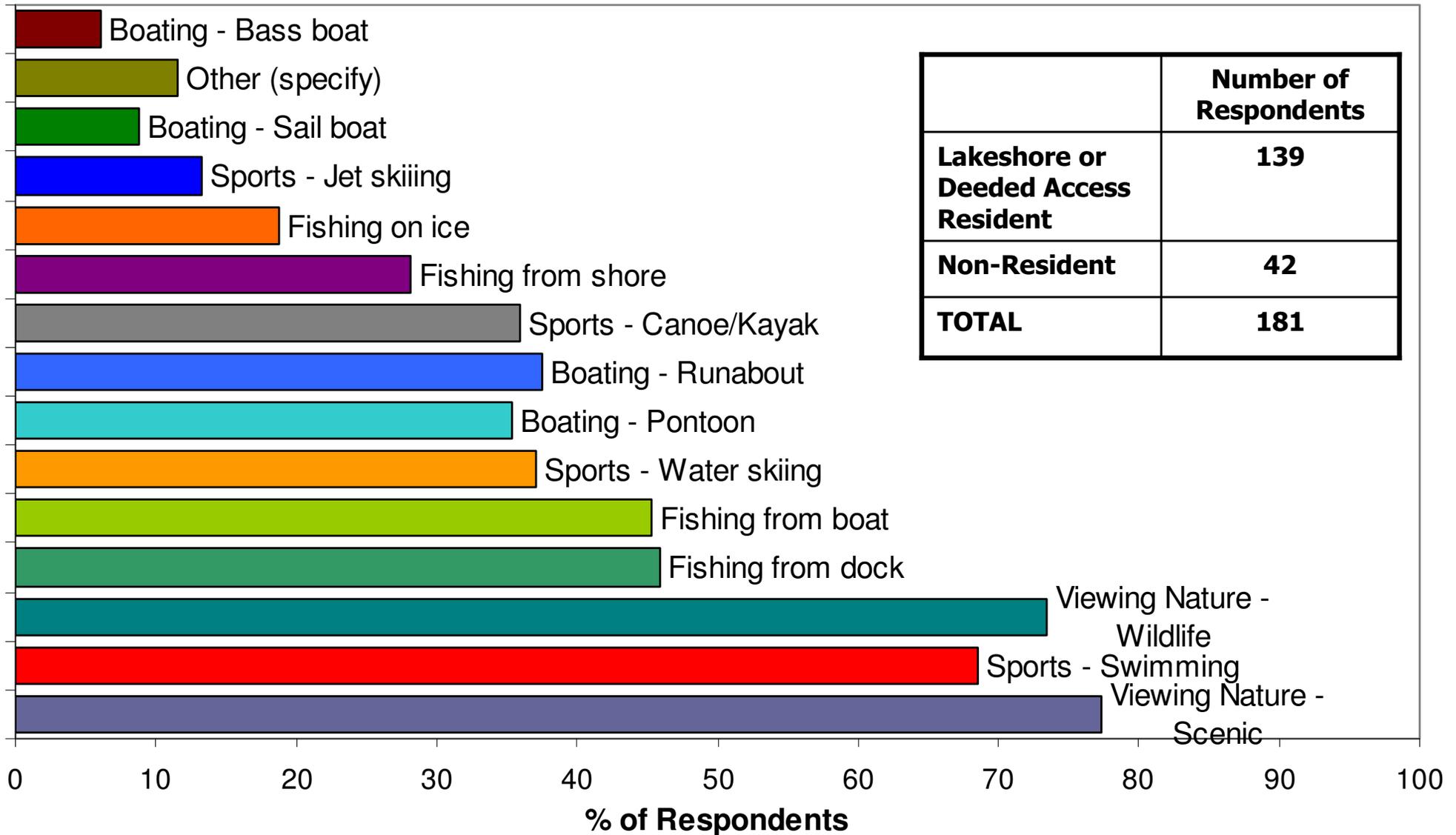
A Variety of Data Evaluated...

- Lake User Survey (2007)
- In-Lake Water Quality Data
 - Total Phosphorus, Chlorophyll a, Secchi Depth, Temperature, Dissolved Oxygen
- Lake Level Data
- Watershed Runoff Volumes and Water Quality Data
- Sediment Cores
- Macrophyte Surveys
- Zooplankton and Phytoplankton Surveys
- Fishery Surveys
- Inflow Inventory



Lake Owasso is Used for Many Recreational Activities

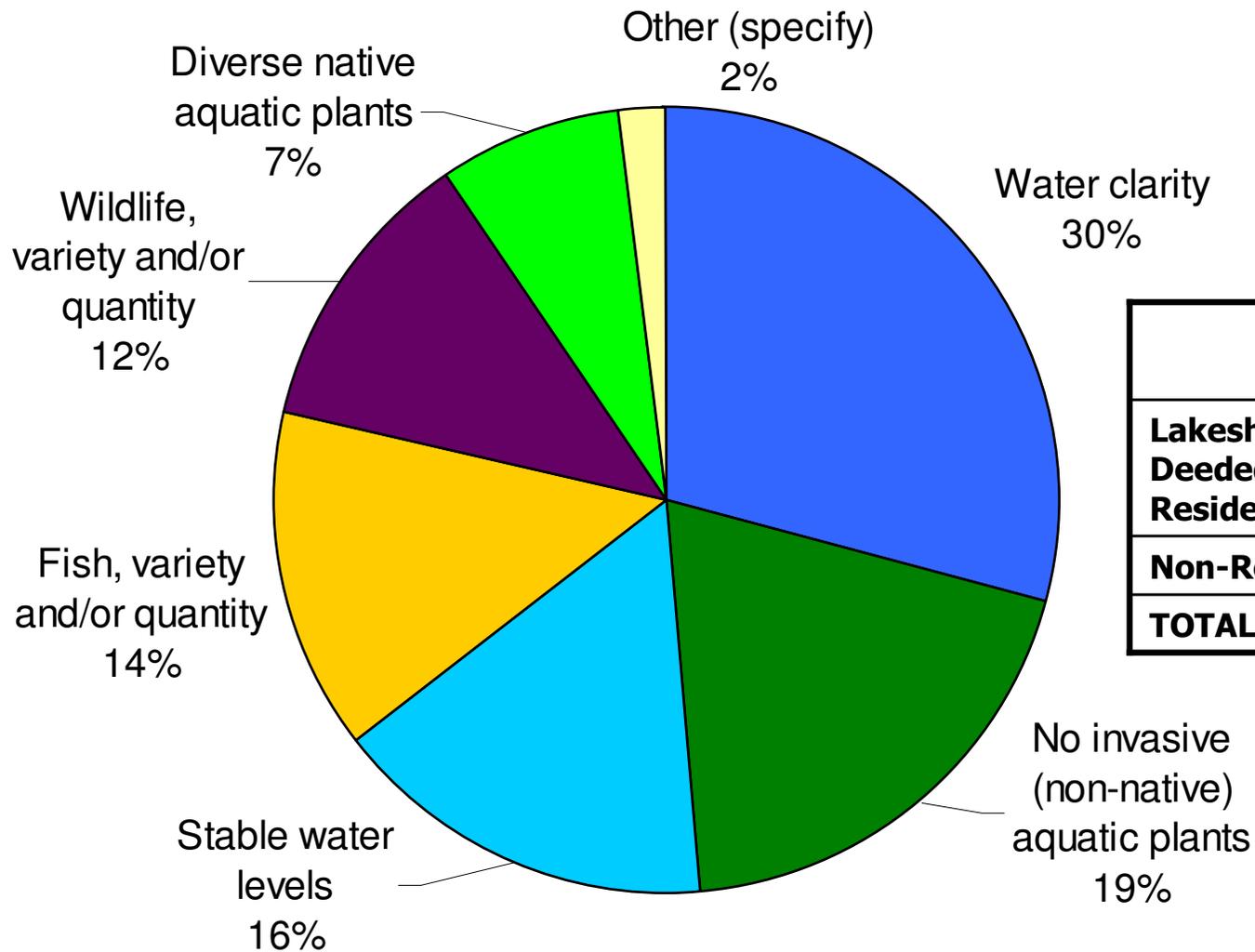
All Respondents



	Number of Respondents
Lakeshore or Deeded Access Resident	139
Non-Resident	42
TOTAL	181

Lake User Survey Respondents Suggests Water Clarity a Concern

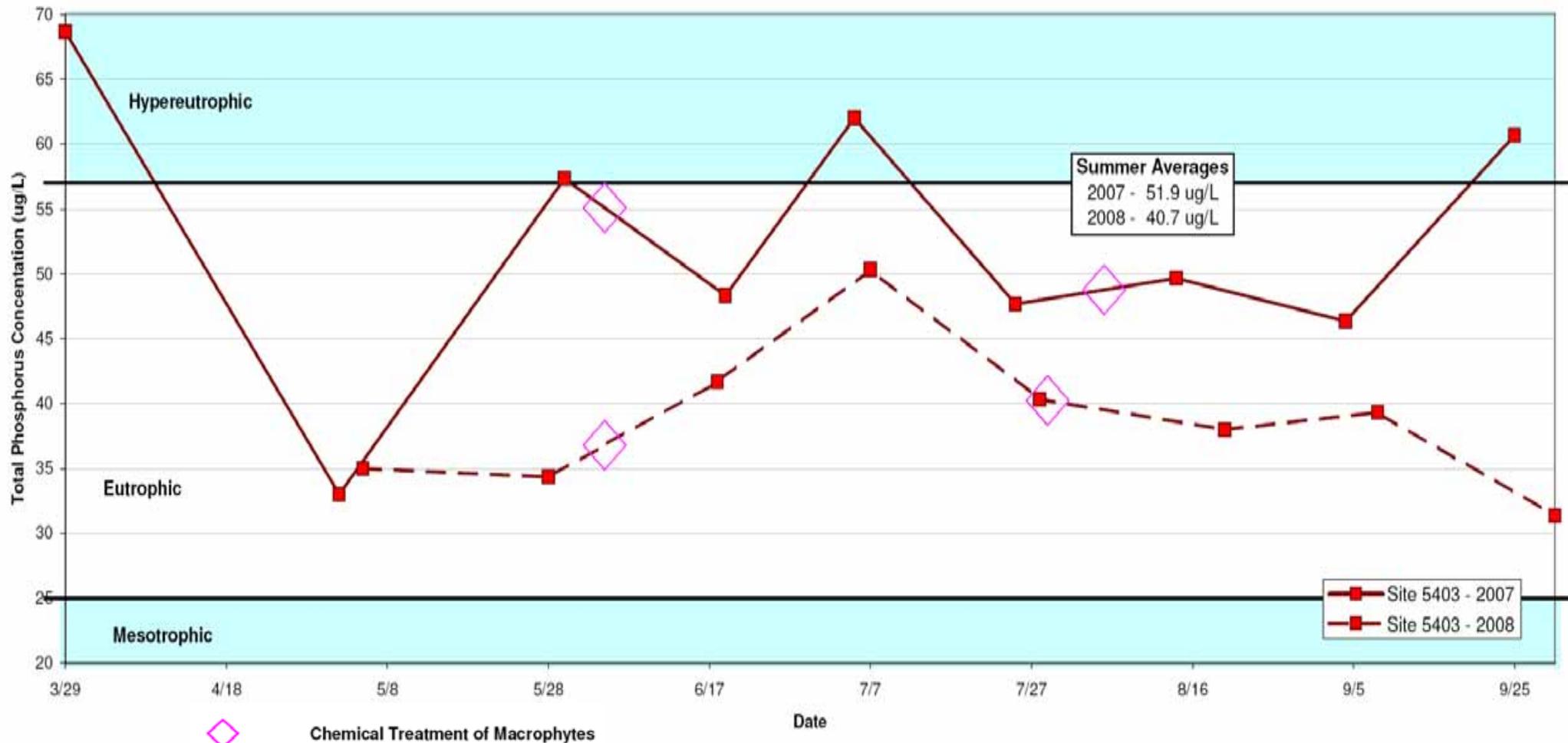
All Respondents



	Number of Respondents
Lakeshore or Deeded Access Resident	139
Non-Resident	36
TOTAL	175

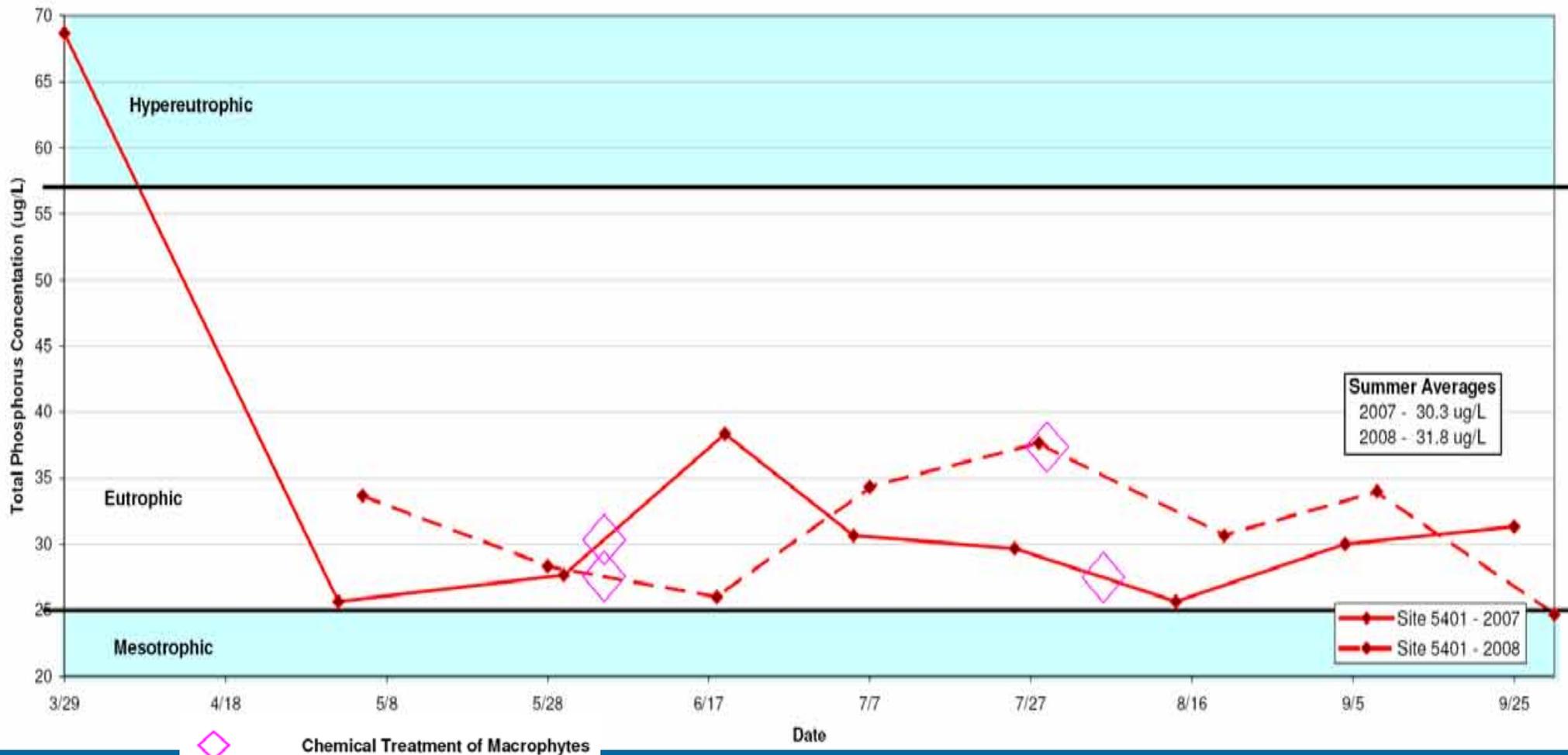
2007 & 2008 Water Quality: South Basin

Lake Owasso
2007 & 2008 Growing Seasons
Trophic Status Plot based on Total Phosphorus Concentration



2007 & 2008 Water Quality: North Basin

Lake Owasso
2007 & 2008 Growing Seasons
Trophic Status Plot based on Total Phosphorus Concentration

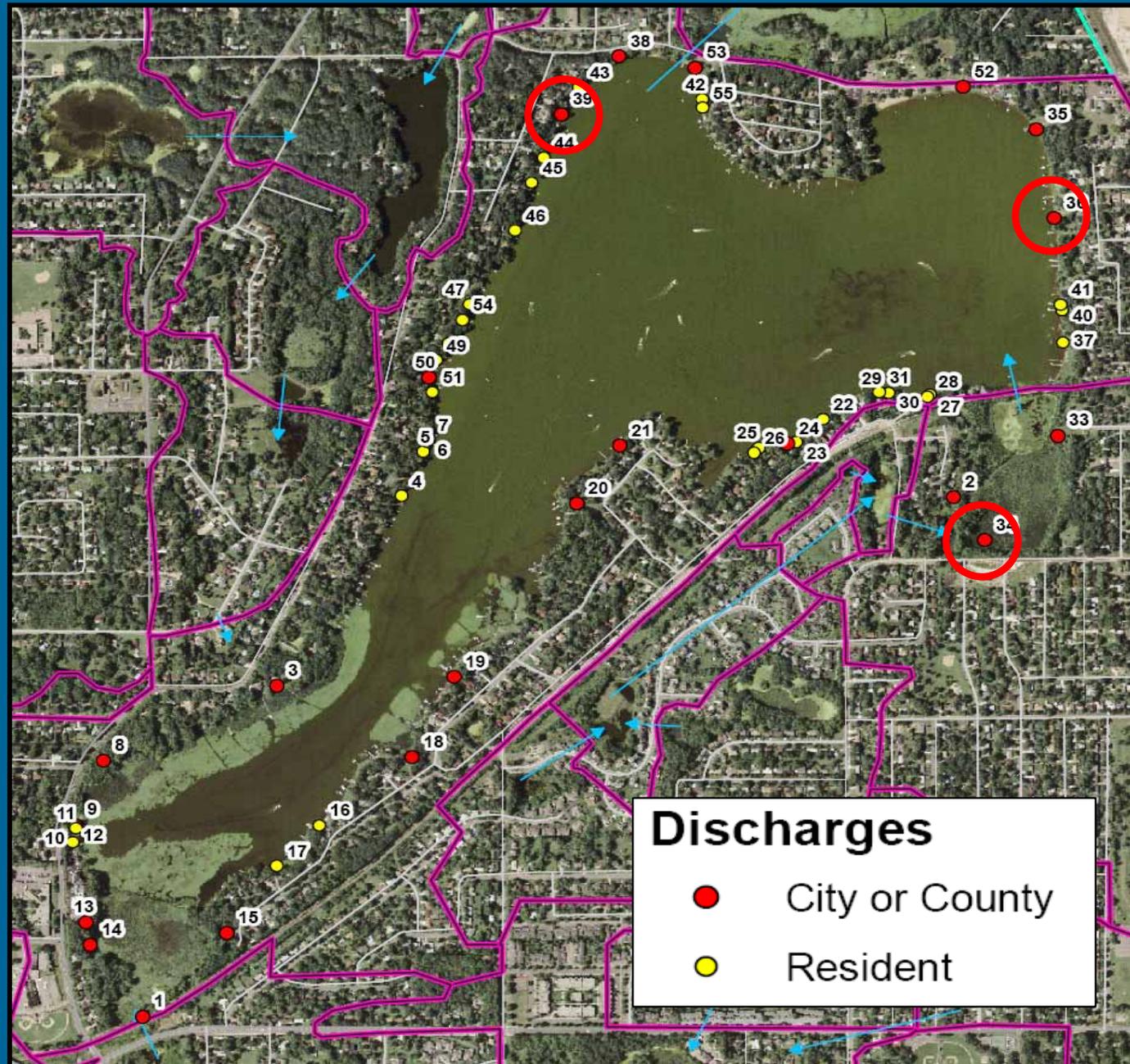


Watershed Analysis Includes Review of Lake Inflow Locations

- Inventory done by the Cities of Roseville & Shoreview Staff – Summer 2007

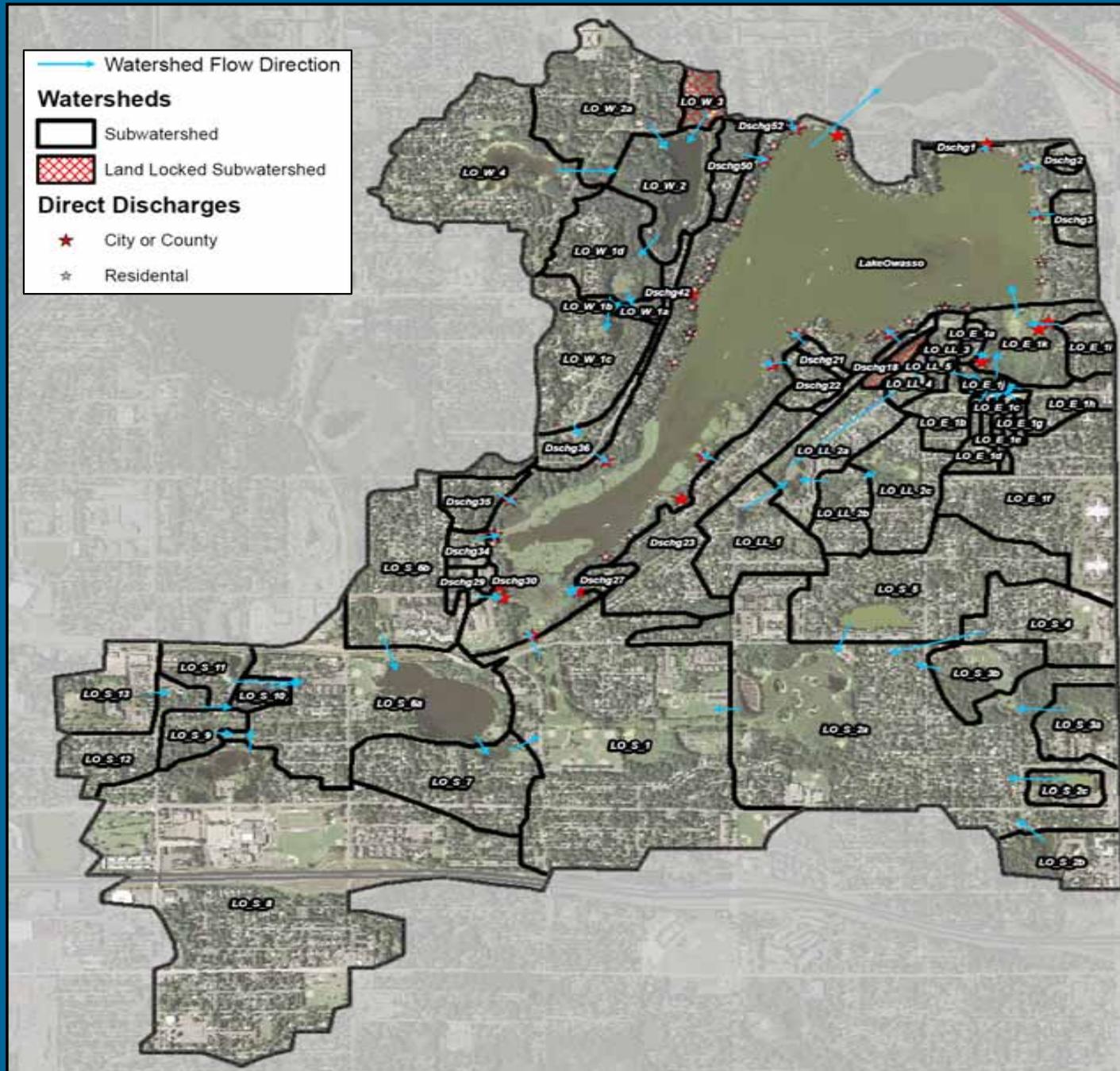
Type	Number
Private	32
Public	23

- The Cities have begun addressing discharges since the beginning of the Lake Owasso UAA process



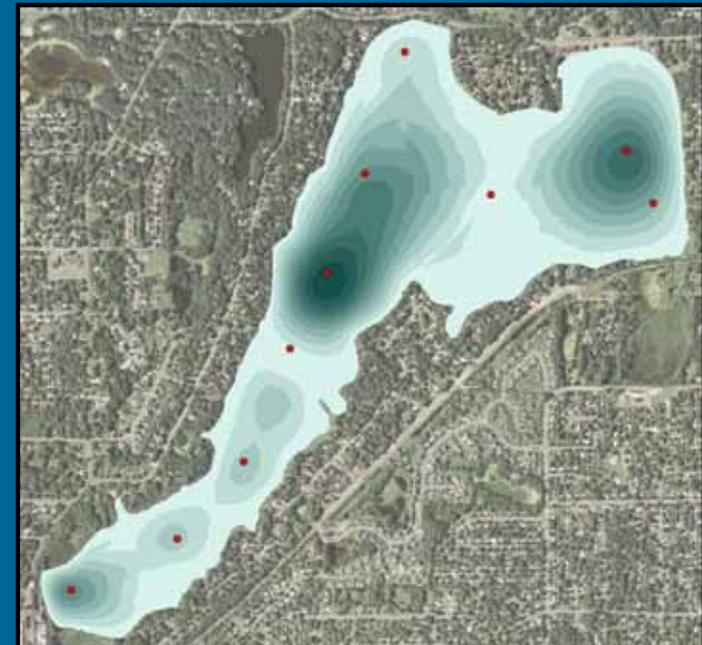
Watershed & In-Lake Water Quality Modeling

- P8 Pollutant Loading Model
- Water Balance Model
- FLUX Model
- In-Lake Mass Balance Water Quality Model

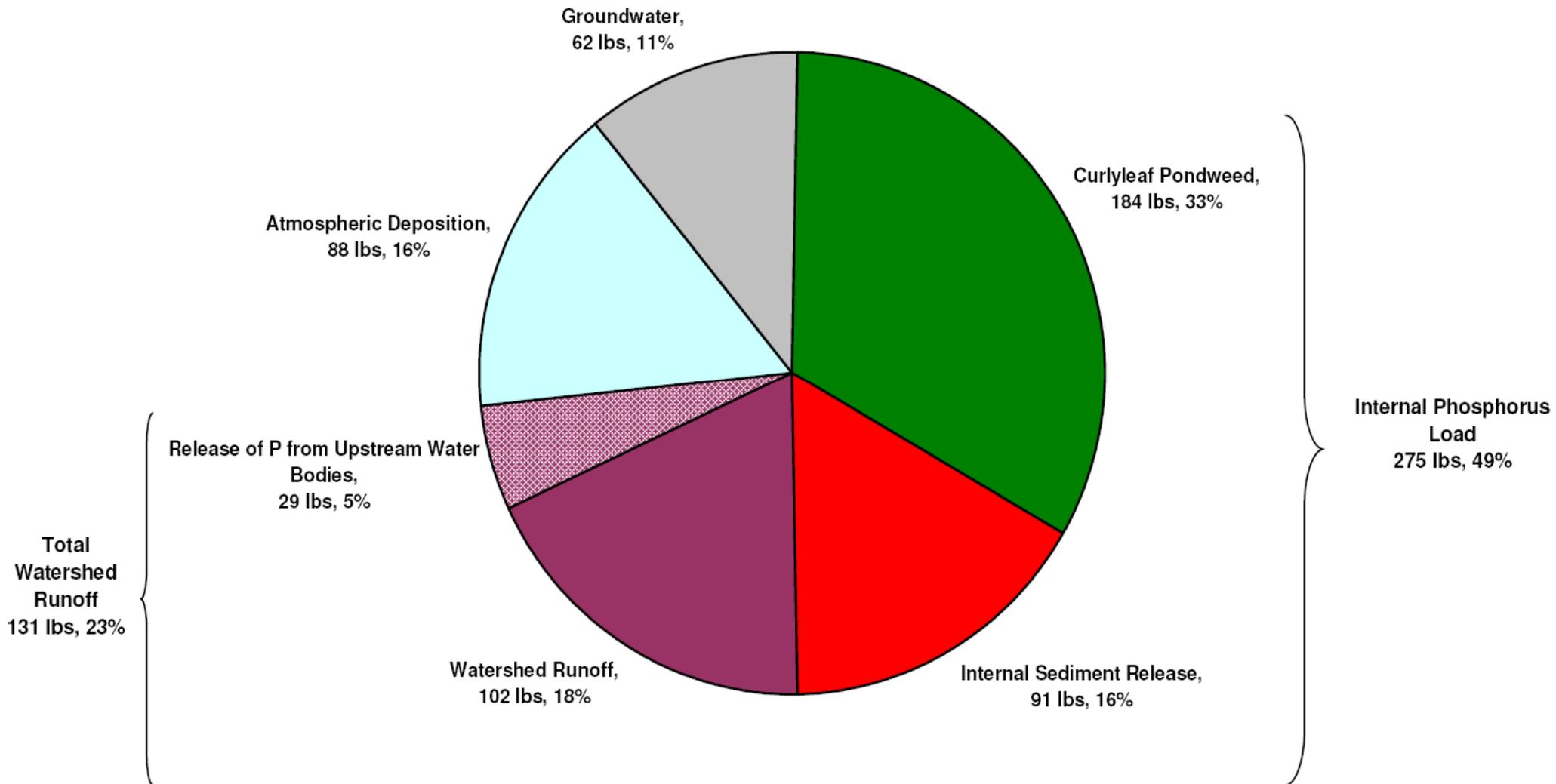


Problems for Lake Owasso

- Curlyleaf pondweed
- Watershed runoff
- Release of phosphorus from upstream waterbodies
- Release of phosphorus from lake bottom sediments



Lake Owasso Phosphorus Budget 2008 Calibration Year



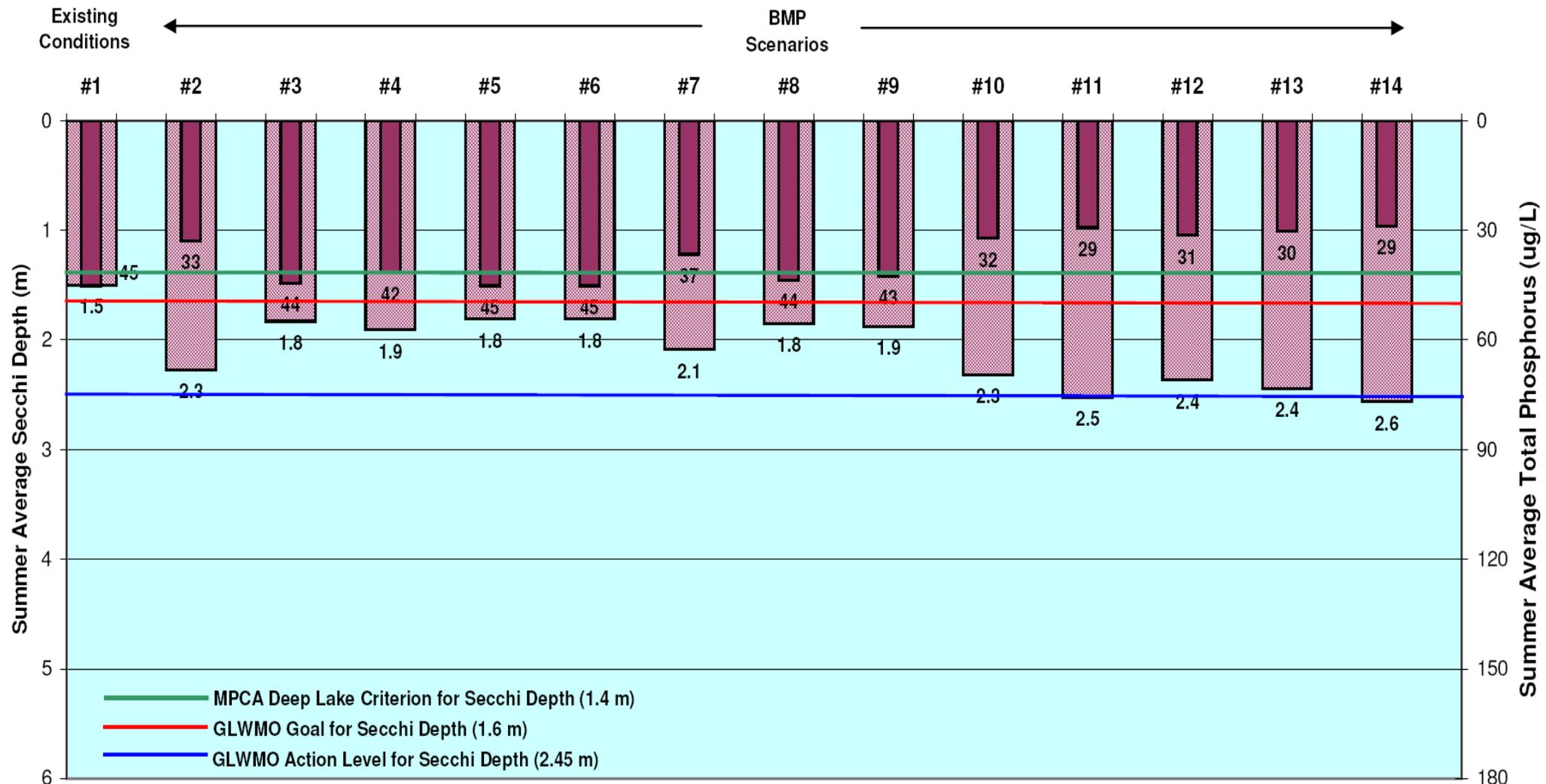
Feasibility Analysis: BMP Combinations

- **Scenario 10** =
 - Scenario 2 (Curlyleaf Pondweed Management)
 - + Scenario 3 (10% Reduction in Watershed Internal Load)
- **Scenario 11** =
 - Scenario 2 (Curlyleaf Pondweed Management)
 - + Scenario 4 (50% Reduction in Watershed Internal Load)
- **Scenario 12** =
 - Scenario 2 (Curlyleaf Pondweed Management)
 - + Scenario 8 (Select Infiltration throughout the watershed)
- **Scenario 13** =
 - Scenario 2 (Curlyleaf Pondweed Management)
 - + Scenario 9 (Alum Treatment)
- **Scenario 14** =
 - Scenario 2 (Curlyleaf Pondweed Management) + Scenario 8 (Select Infiltration throughout the watershed) + Scenario 9 (Alum Treatment)

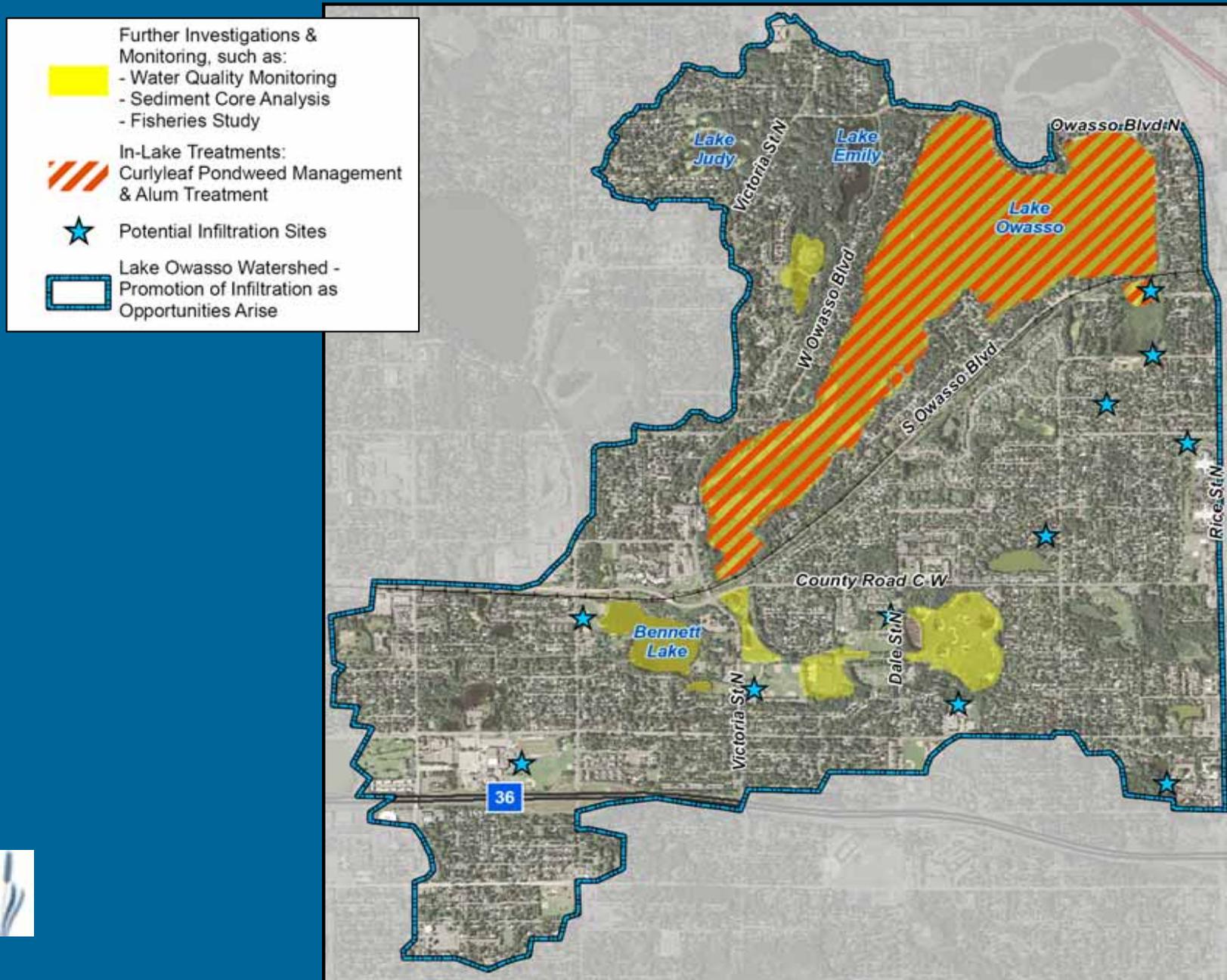


Feasibility Analysis: BMP Combinations

Lake Owasso Water Quality
Average Year (2005) Climatic Conditions



Recommendations

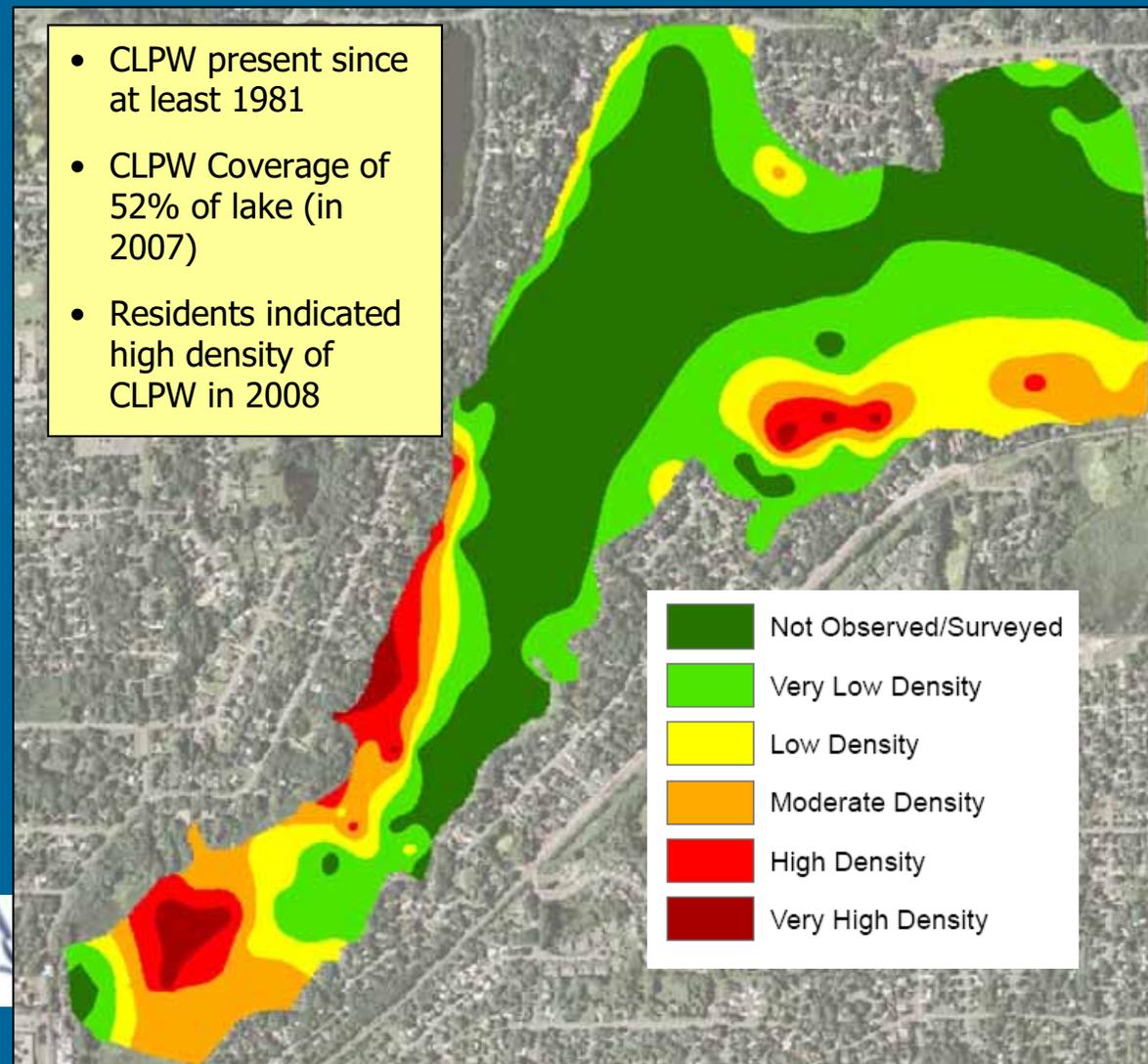


Recommendations

Recommendation 1:

Curlyleaf Pondweed Management (4 Year Plan)

- CLPW present since at least 1981
- CLPW Coverage of 52% of lake (in 2007)
- Residents indicated high density of CLPW in 2008



- MDNR Treatment Permit and Variance
- Permission of Lake Homeowners
- Herbicide treatment targeting Curlyleaf pondweed (Endothall/late-April or early-May)
- Aquatic Plant Monitoring
- Biomass Monitoring
- Turion Monitoring
- Herbicide Residue Monitoring
- Analysis and Reporting

Recommendations

Recommendation 2:

Further Monitoring & Studies

- Water Quality Monitoring in Central Park – East and West Wetlands and the Charlie Pond System
- Fisheries Impact Study – focusing on carp movement and activity in the Lake Owasso - Central Park – West wetland – Bennett Lake system
- Sediment Core Analysis in Central Park – East and West Wetlands, the Charlie Pond System, and Bennett Lake
- Water Quality Monitoring in Lake Owasso – Shallow Site



Recommendations

Recommendation 3:

Continued Implementation of Infiltration BMPs

- Implement throughout the watershed as opportunities arise and where site conditions allow
- Potential infiltration sites identified



Recommendation 4:

Continued Implementation of Nonstructural (“Good Housekeeping”) BMPs

- Promotion of vegetated shoreline buffers
 - Filters direct runoff
 - Discourages geese and waterfowl
- Street sweeping
- Public Education



Recommendations

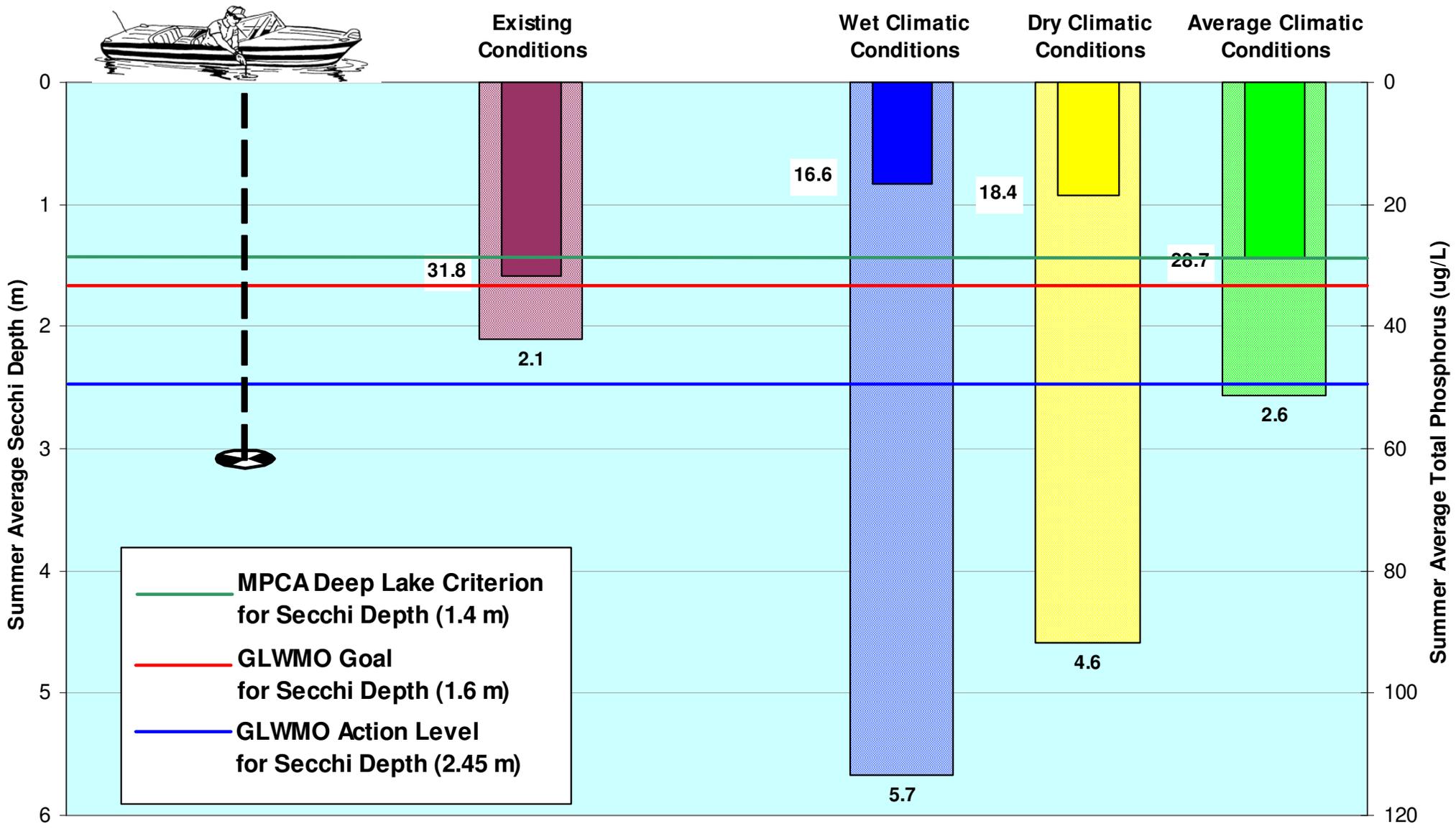
- Based on results of the implementation of the other recommendations and studies, other potential BMPs may include:
 - Alum treatment of the lake
 - Fisheries management (rough fish, carp barriers, harvesting)
 - Address internal loading from upstream wetlands and water bodies



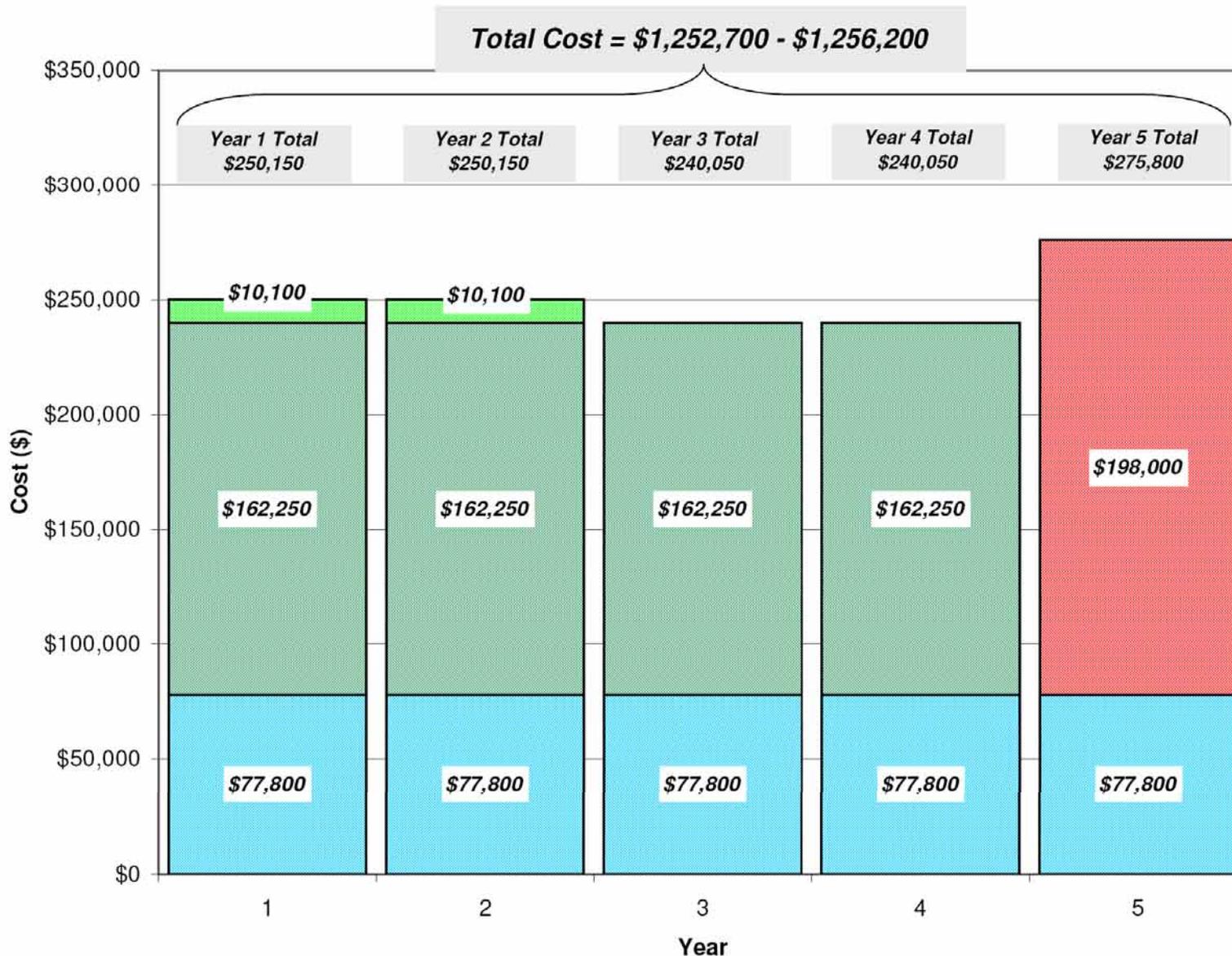
Recommended BMP Scenario

Scenario 14: Curlyleaf Pondweed Management, Promote Infiltration in Watershed, Alum Treatment

Recommended BMPs Scenario 14



Recommendations: Estimated Costs and Timelines



Lake Owasso UAA Final Recommendations

Studies/Investigations

Total Cost = \$8.800 - \$20.200

- Water quality monitoring in the Central Park and Charlie Pond systems (\$7,000 - \$9,500)
- Fisheries study (\$TBD) - cost not included
- Sediment core analysis in Central Park, Charlie Pond, and Bennet Lake systems (\$7,900)
- Water quality monitoring in Lake Owasso shallow areas (\$1,800 - \$2,800)

Watershed Infiltration

Total Cost = \$389,000

Actual locations, cost, and timing of infiltration projects to be determined as opportunities arise. Does not include costs of feasibility studies or excavation and construction required to reroute flows to proposed infiltration practices.

Curlyleaf Pondweed Management

Total Cost = \$649,000

Costs include herbicide treatments, monitoring, and reporting

Alum Treatment

Total Cost = \$198,000

Alum treatment contingent upon the impact of the Curlyleaf pondweed management on water quality

Additional Recommendations

- Public Education and Outreach
- Routine Maintenance
- Street Sweeping Programs

Costs for Public Education and Outreach, Routine Maintenance, and Street Sweeping Programs included in Cities' annual budgets. Actual costs not shown.

Any questions or comments??

