Managing an Urban Lake

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Lake Oswego Corporation

Mission Statement

The mission of the Lake Oswego Corporation is to maintain and improve Oswego lake and to protects its value and quality of life for its shareholders.

Carrying out the Mission

- Maintain Safety
  - Lake Safety Patrol
  - Enforce Lake Rules
- Maintain Privacy
  - Regulate Access
- Maintain Water Quality

Carrying out the Mission

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Maintain Water Quality

- Lake Sampling
- Watershed Sampling
- Plant Control
- Algae Control
- Nutrient Control
- Invasive Species Control

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Lake Sampling Program

- Weekly Sampling
  - YSI Sonde
    - Temperature
    - Dissolved Oxygen
    - pH
    - Conductivity
  - Secchi Disk
  - Turbidity

Lake Sampling Program

- Bi-Weekly Sampling
  - Nutrients
    - Total Phosphorus
    - Soluble Phosphorus
    - Total Nitrogen
  - Total Suspended Solids
  - Chlorophyll *a*

Lake Sampling Program

- Seasonal Sampling
  - Zooplankton
    - Summer: bi-weekly
    - Winter: monthly
  - Phytoplankton
    - Summer: semi-weekly
    - Winter: monthly
  - Macrophytes
    - Bi-weekly surveys in summer

Maintain Water Quality

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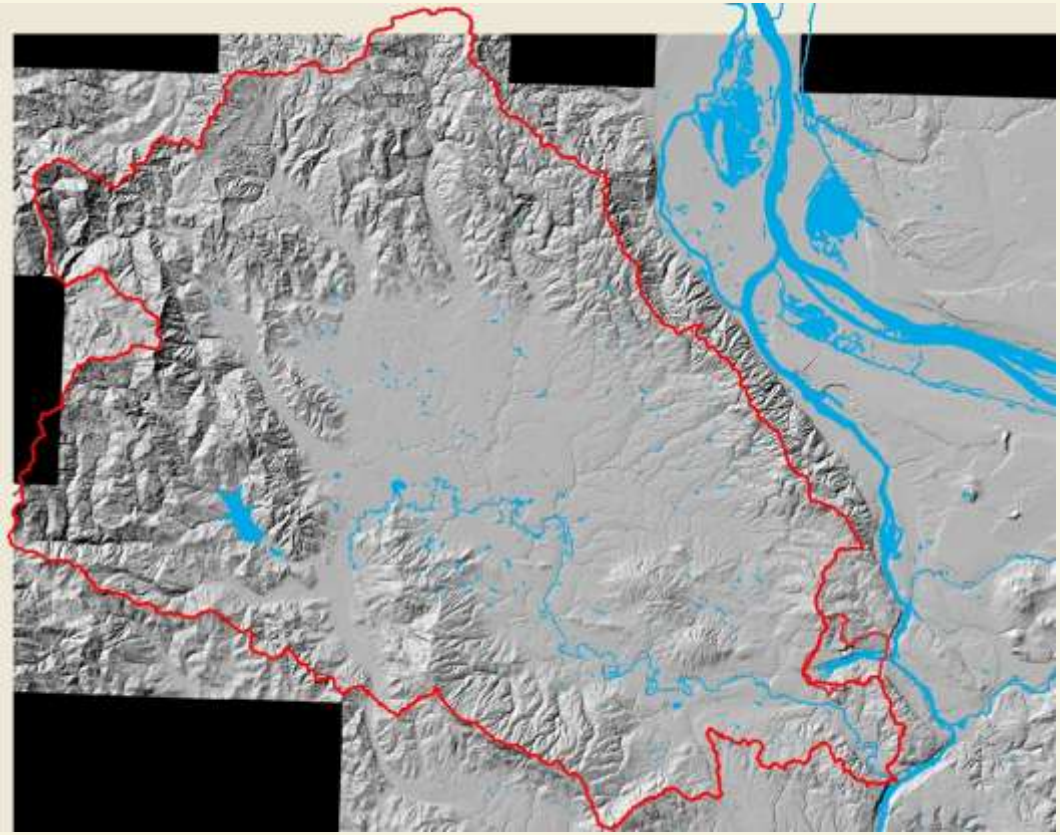
Watershed Sampling Program



Tualatin watershed = 1841 km^2 (710 mi^2)

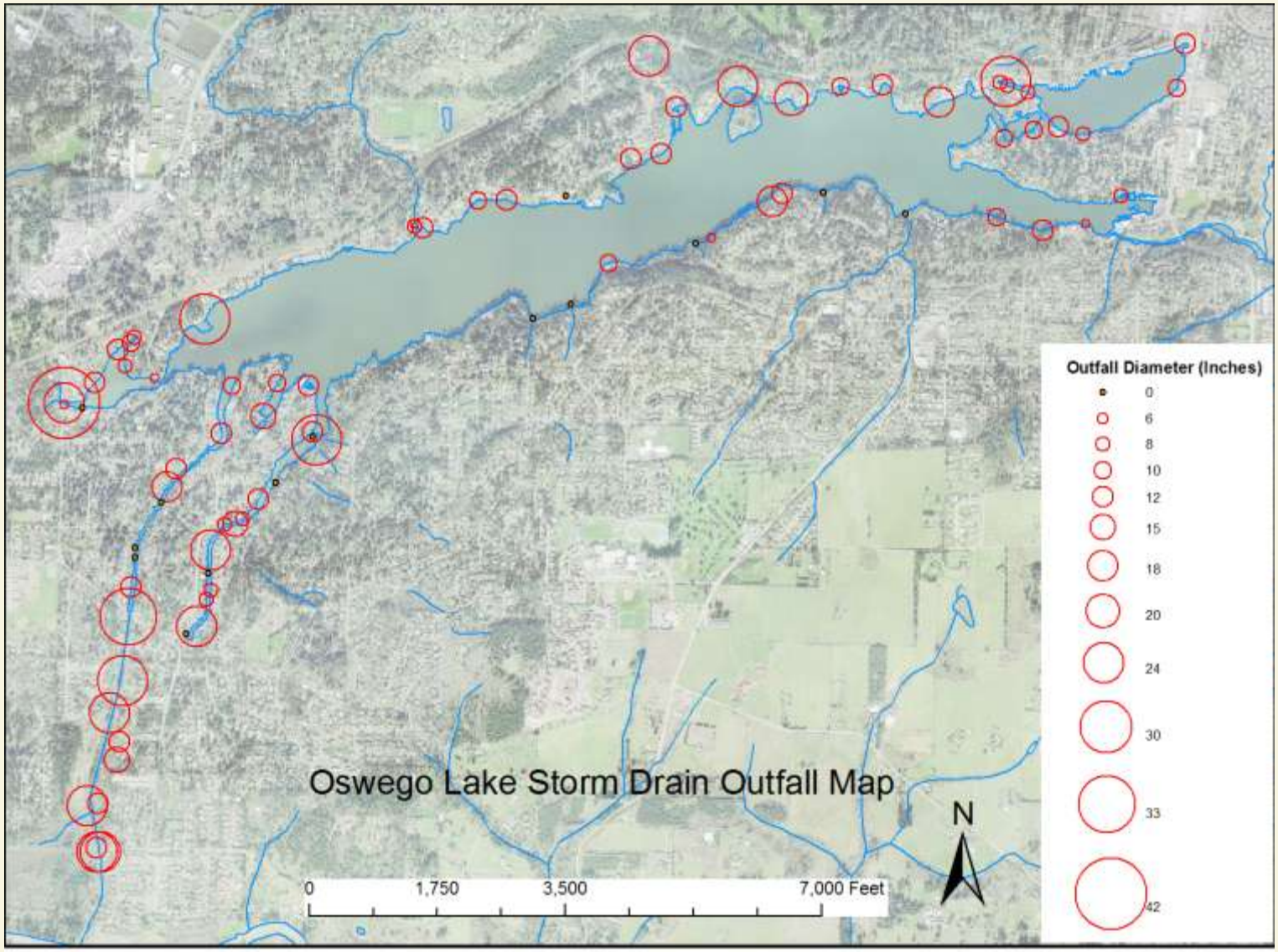
Area	168 ha	(415 acres)
Length	5.1 km	(3.2 miles)
Width	0.56 km	(0.35 mile)
Max Depth	16.7 m	(55 feet)
Mean Depth	7.86 m	(26 feet)
Volume	12.717 million m^3	(10,300 acre ft)
Oswego Canal	2.2 km	(1.4 miles)

Oswego watershed = 17 km^2 (4200 acre)

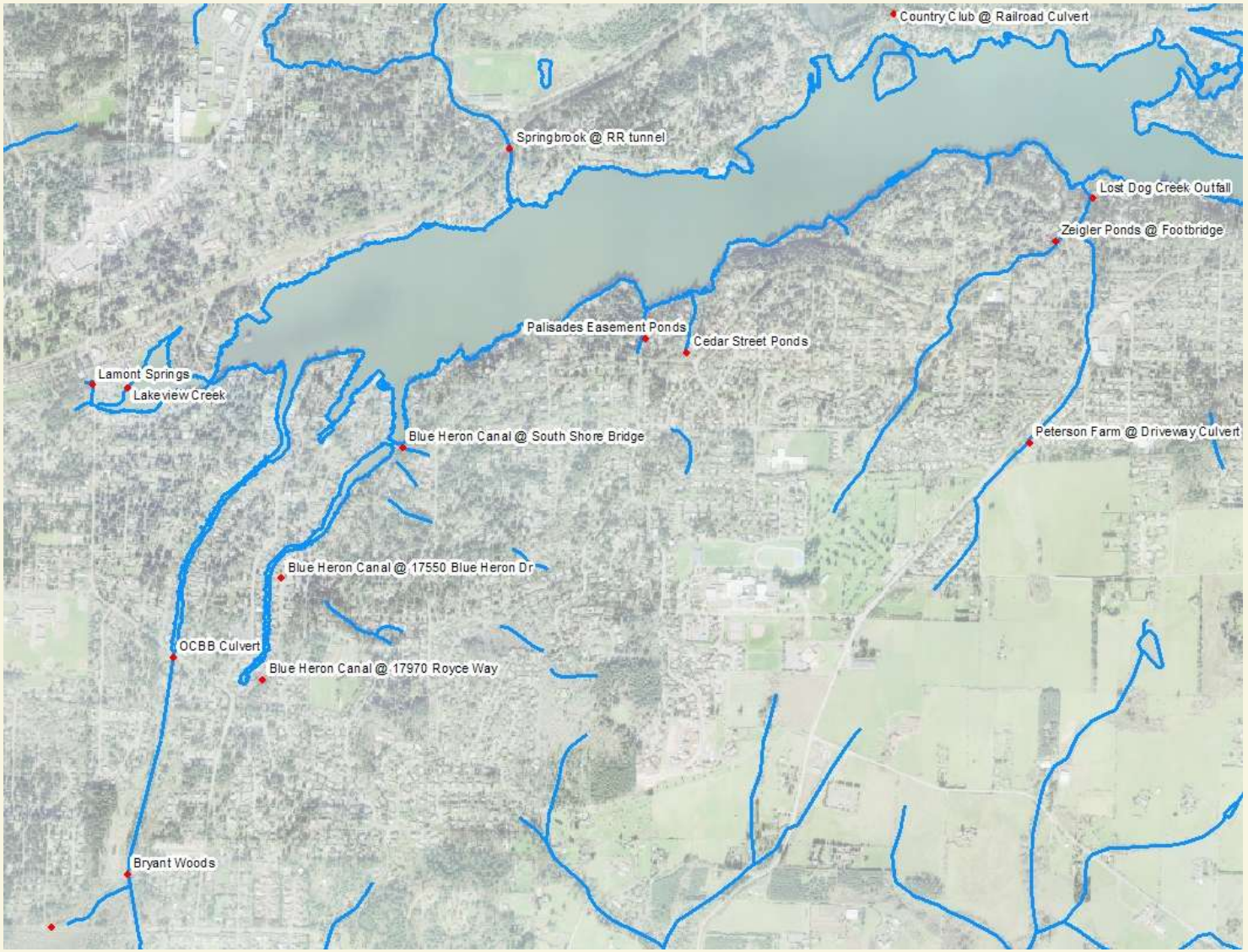
Watershed Sampling Program

- Storm Sampling
  - Phosphorus and Turbidity
  - Summer
    - Occasional baseflow sampling
  - Winter
    - Stormwater outflow sampling

Watershed Sampling Program



Watershed Sampling Program



Maintain Water Quality

- Lake Sampling
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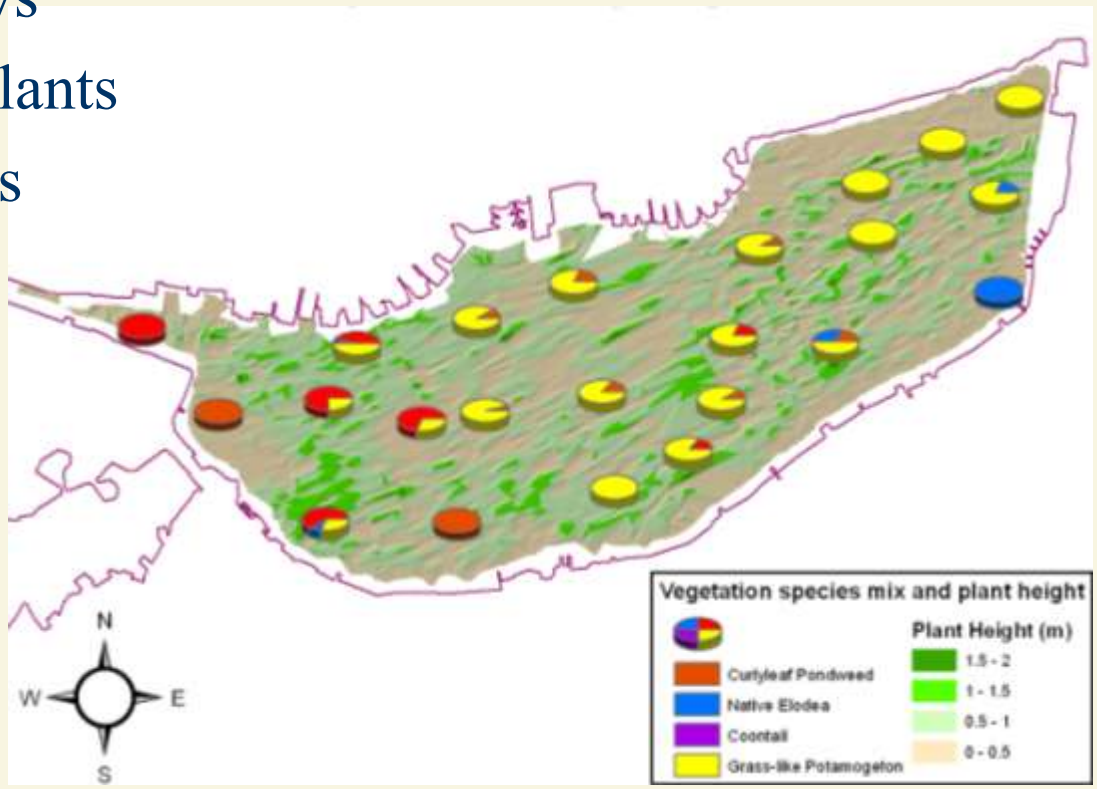
Plant Control Methods

Plant Surveys

- Visual Surveys
- Hydroacoustic Surveys
- Invasive non-native plants
- Nuisance native plants



Plant Control Methods

- Harvester
  - Small scale, shallow areas
- Diver Hand-pulling
  - Non-native vegetation
- Herbicide
  - Non-native vegetation
  - MAO with DEQ
  - Contact and systemic
- Drawdown
  - Freeze them
  - Pull them

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Algae Control Methods

- Algaecide
  - NO copper used
  - Limited peroxide use
  - Skimmers
  - Primarily through nutrient control

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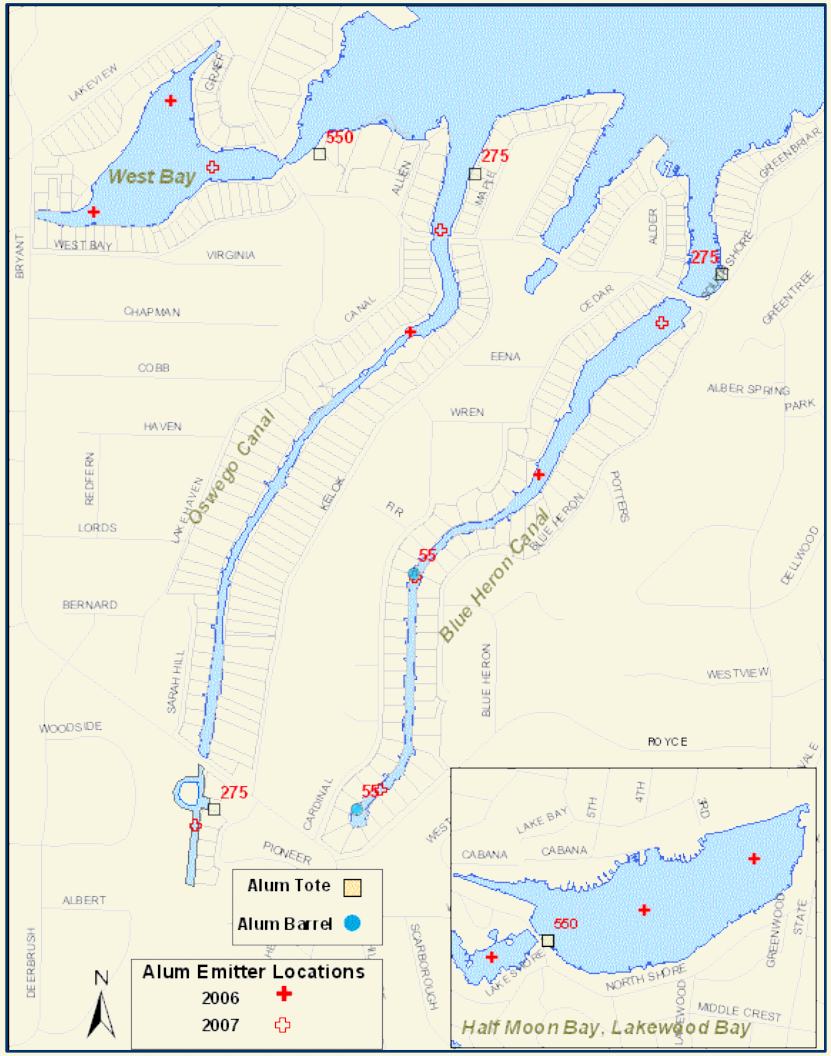
Nutrient Control Methods

- Phosphorus Reduction
  - Alum injection
  - Alum surface applications
  - Aeration
  - Limiting Tualatin intake
  - Phosphorus-free fertilizer
  - Educating Lake users
  - Watershed improvements

Nutrient Control Methods

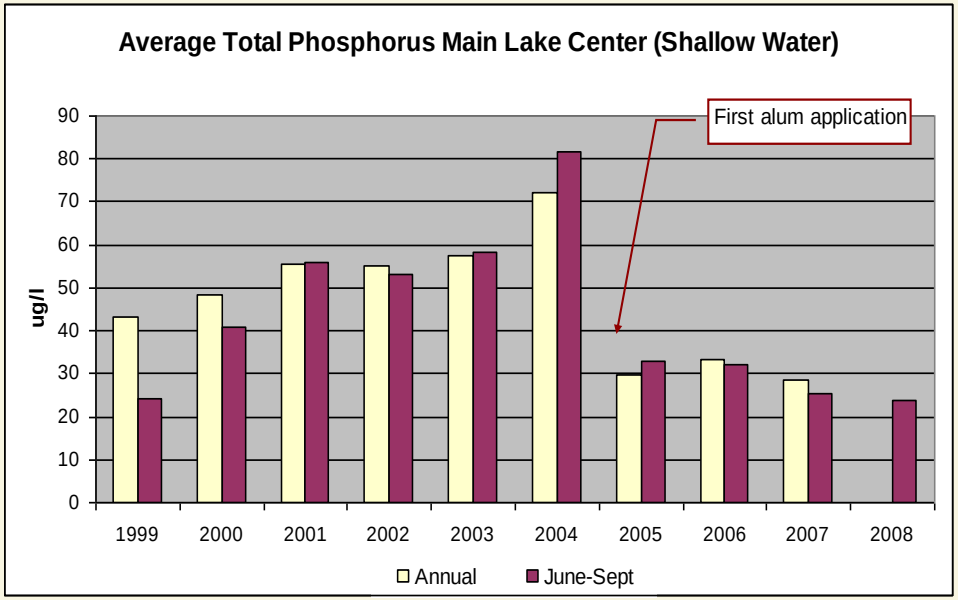
Alum Injection

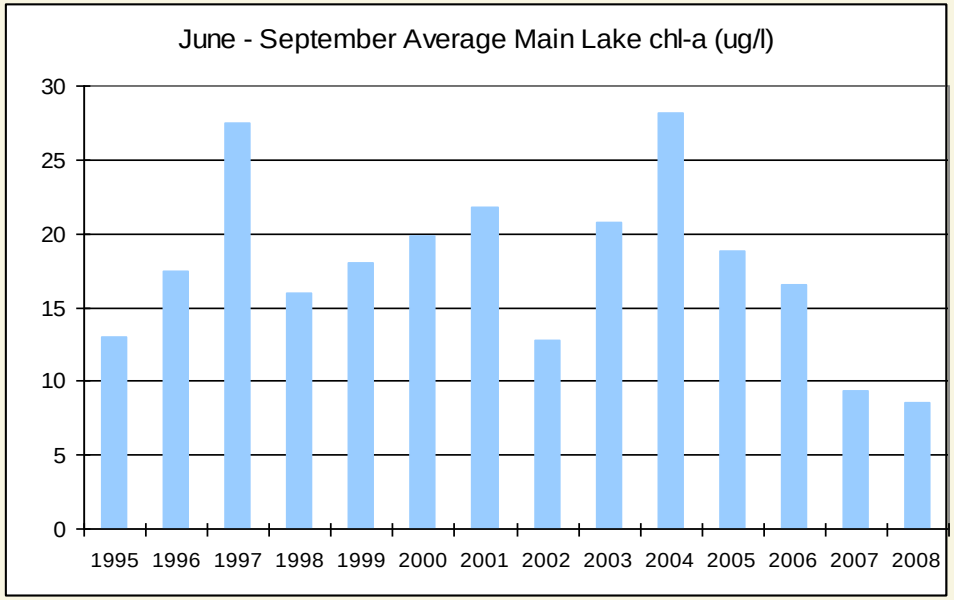


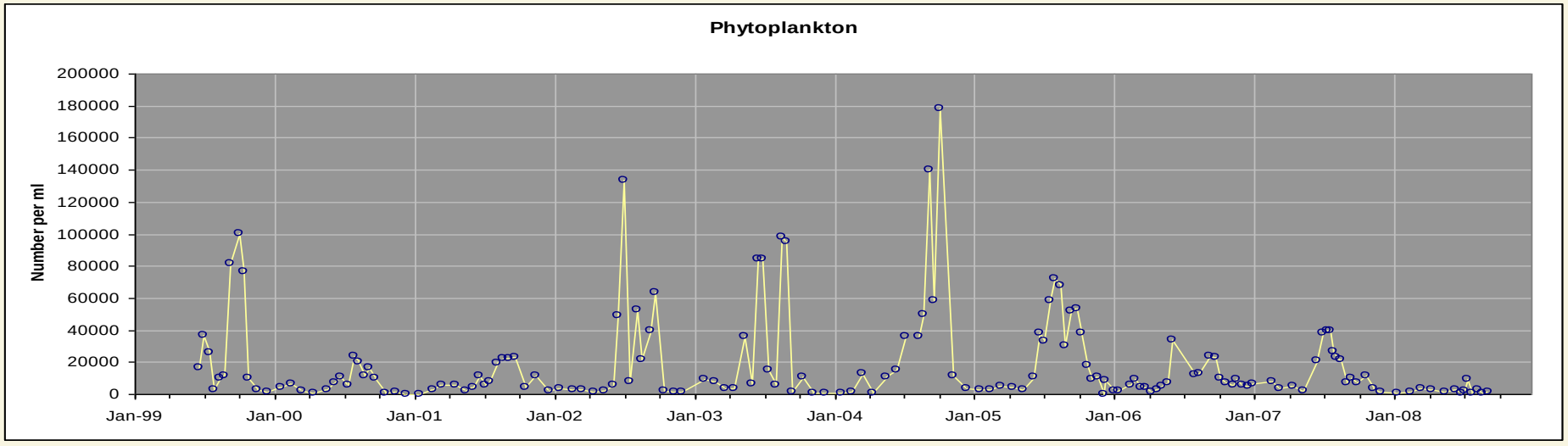
Nutrient Control Methods

Alum surface application

Nutrient Control Methods

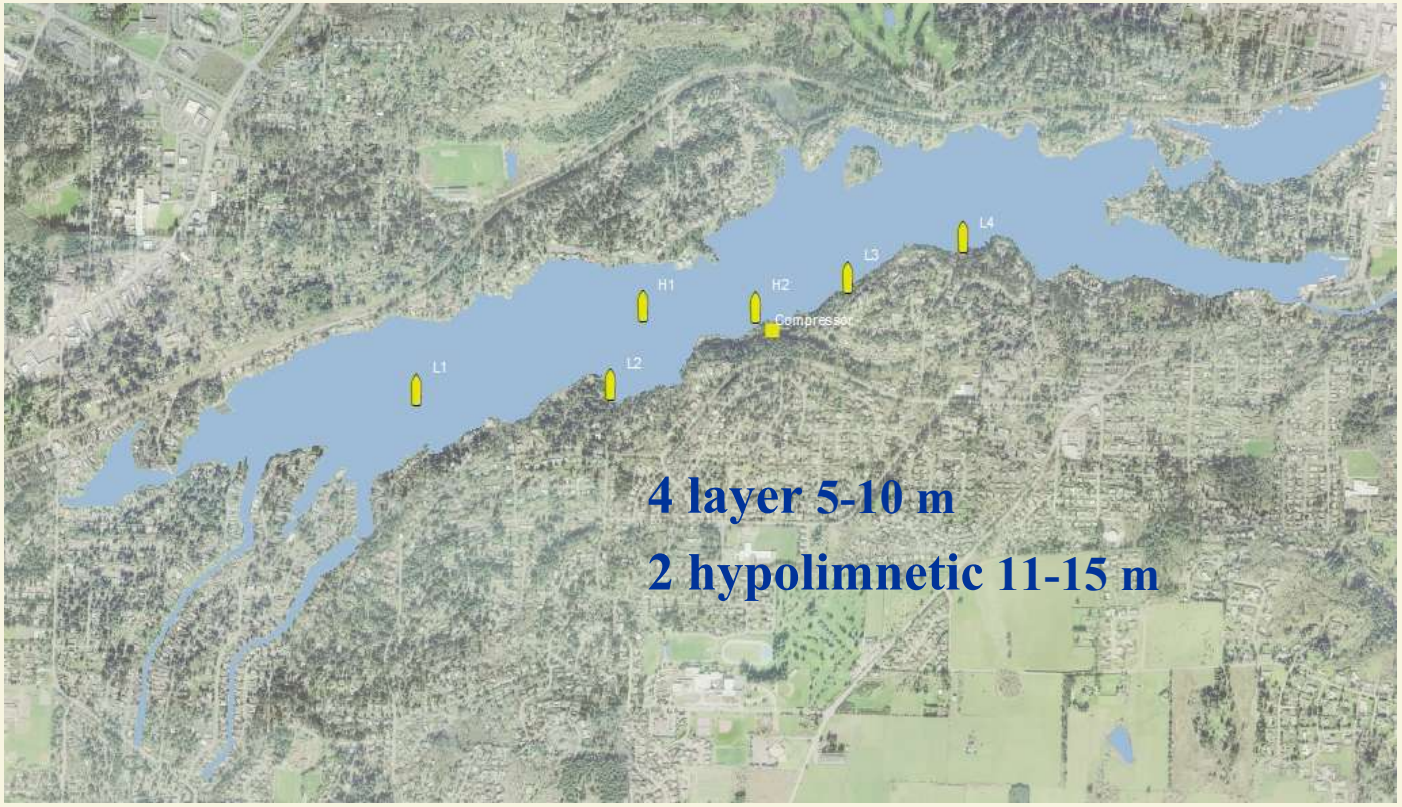






Nutrient Control Methods

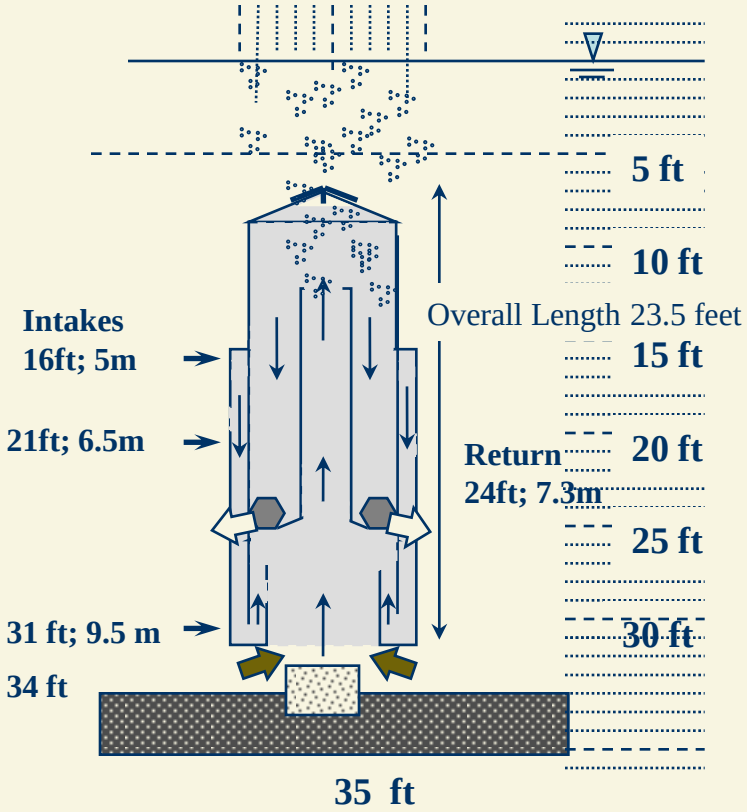
Hypolimnetic Aeration



Nutrient Control Methods

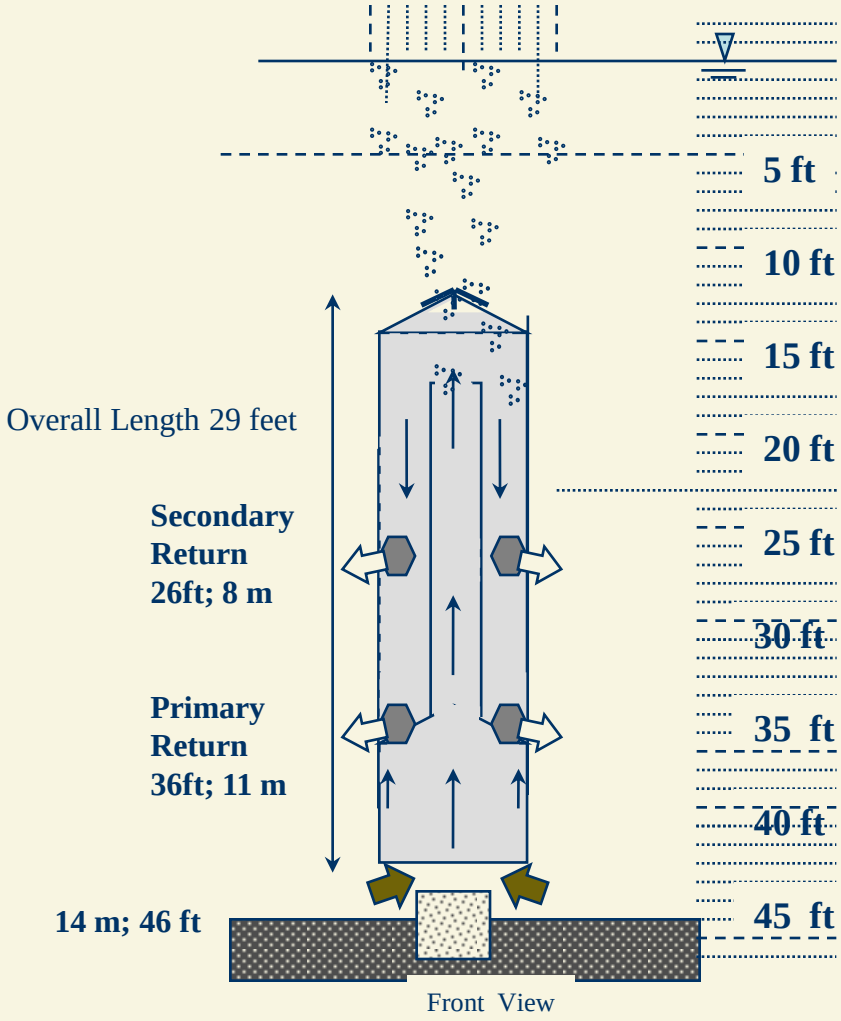
Layered Aerator (4)

Several Levels of Intakes are available for adjusting the depth zone of the layer, Initially the top two horizontal intakes are opened.



System

Hypolimnetic Aerator (2)



Nutrient Control Methods

Hypolimnetic Aeration

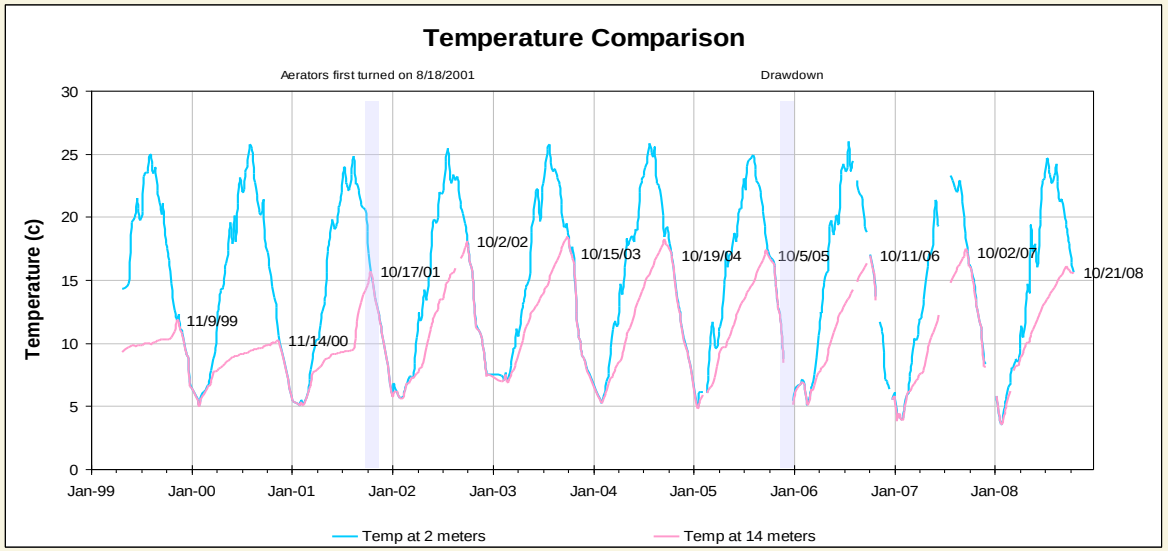
Nutrient Control Methods

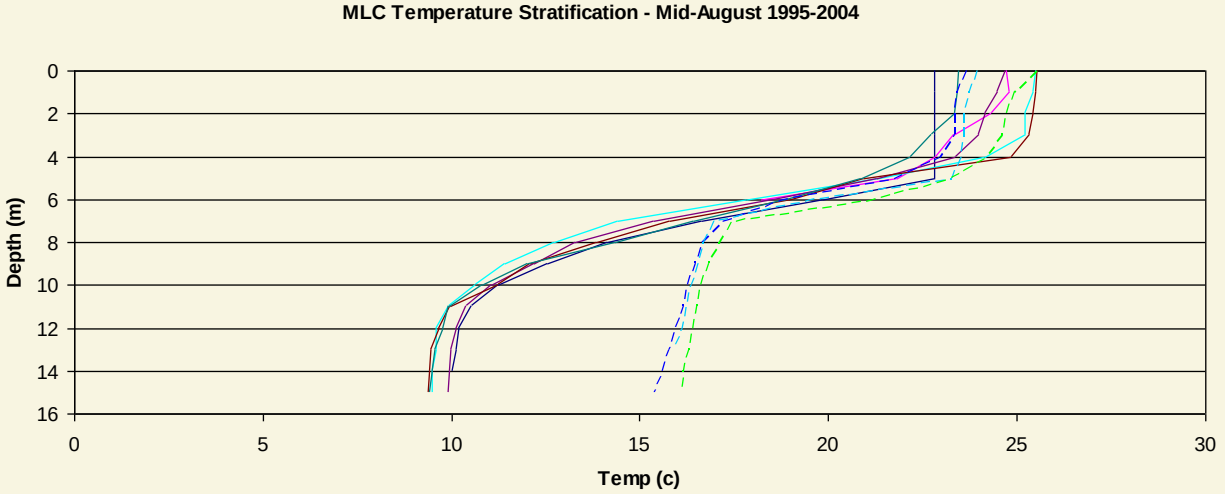
Aeration Effectiveness

Nutrient Control Methods

Aeration Effectiveness

Early Turnover
Warmer Hypolimnion
Potential Re-stratification





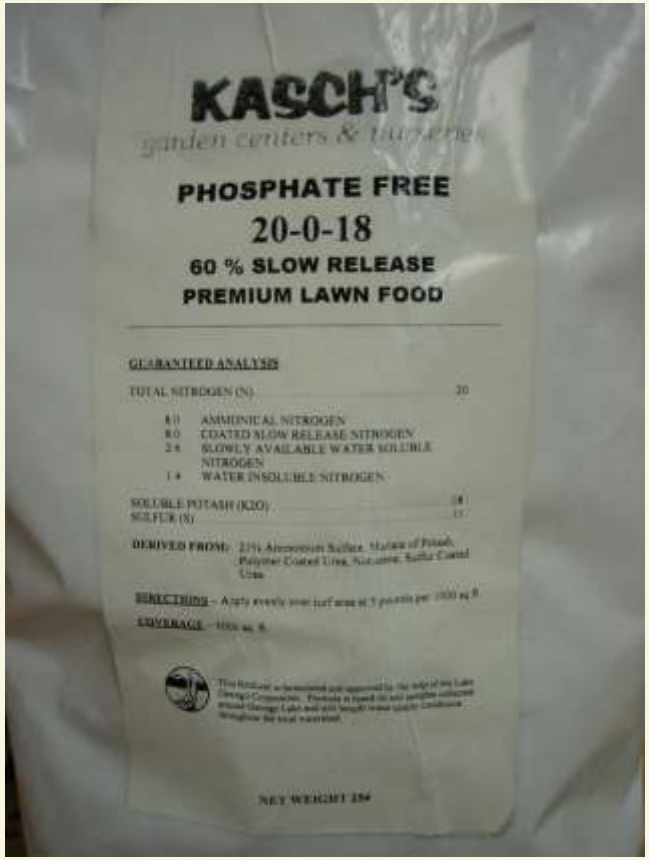
Nutrient Control Methods

Limiting Tualatin River intake

Nutrient Control Methods

Phosphorus free fertilizer

- Encouraged city-wide ban in 1999 and 2006
- Formulated our own fertilizer in 2000
- Multiple vendors offer P-free currently



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Invasive Species Control

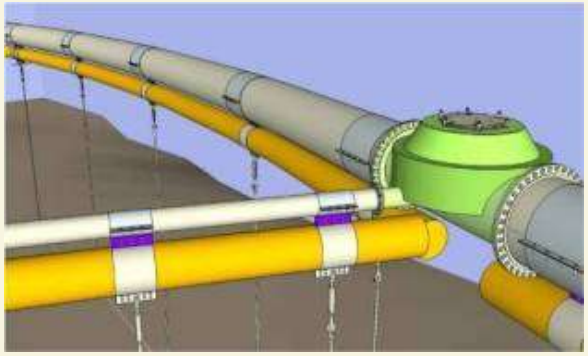
- Invasive species already here
  - Brazilian elodea (*Egeria densa*)
  - Curlyleaf pondweed (*Potamogeton crispus*)
  - Nutria
- Invasive species not yet here
  - Eurasian watermilfoil
  - Zebra mussel

Invasive Species Control

Fishscreen

Generator

Floating Sewer



Invasive Species Control

Federal invasive species rules fall short, Oregon says

by Michael Milstein, The Oregonian
Sunday October 26, 2008, 9:52 PM

Motoya Nakamura/The Oregonian

Ships dock at Swan Island on the Willamette River. A typical carrier discharges as much water as 3 1/2 Olympic-size swimming pools and can release alien fish and snails. Ships are required to empty ballast water at least 200 miles offshore, but that probably doesn't fully flush the tanks.

Invasive Species Control

- Boat cleaning / tagging

Capital Projects

- Headgate Modification
  - Reduce amount of water over headgate during flood
- Leak Repair
  - Stop water from leaking through powerhouse
- Dredge
  - Remove nutrient rich sediment
  - Increase water depth
  - Reduce seedbank in sediment


Thank You