Algae and Nuisance Aquatic Vegetation

for

RappFLOW Pond Workshop

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Definition

Q: What is “nuisance” aquatic vegetation?

A: Any vegetation that is growing in an area where it is not wanted, or where it affects the aesthetic, ecological, recreational, or functional integrity of the water body

Outline

Part 1: Factors Contributing to Excessive Growth

Part 2: Types of Nuisance Vegetation

Part 3: Management Strategies

Part 4: Case Study

PART 1:

Factors Contributing to Excessive Growth

PART 1: Factors Contributing to Excessive Growth

A. Nutrient Loading

B. Shallow Depths

C. Hot, Dry Weather

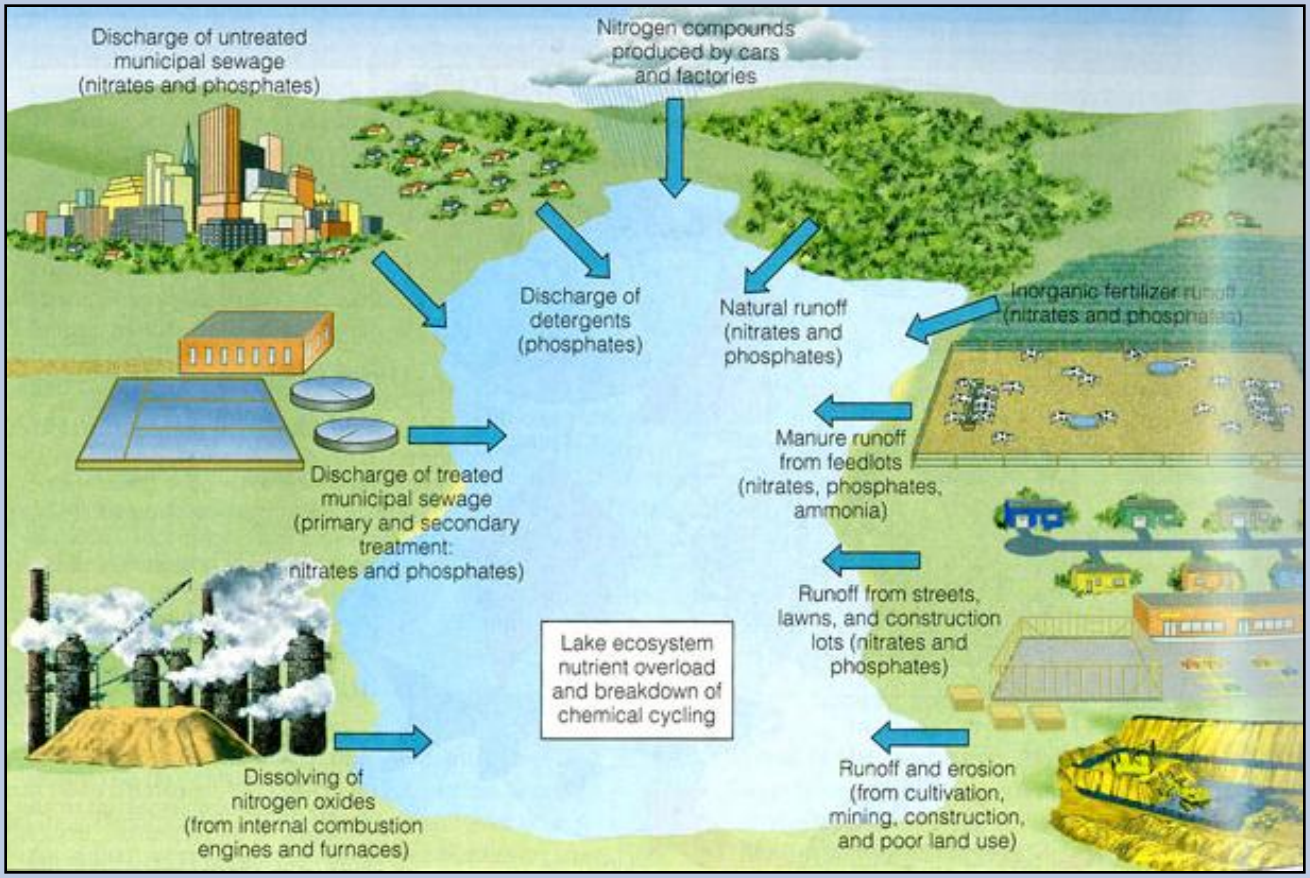
PART 1: Factors Contributing to Excessive Growth

A. Nutrient Loading

1. Nitrogen and Phosphorus contribute to the growth of nuisance vegetation in the same way that these fertilizers improve the growth of lawns and gardens

PART 1:

Factors Contributing to Excessive Growth



Source: Thinkquest.org

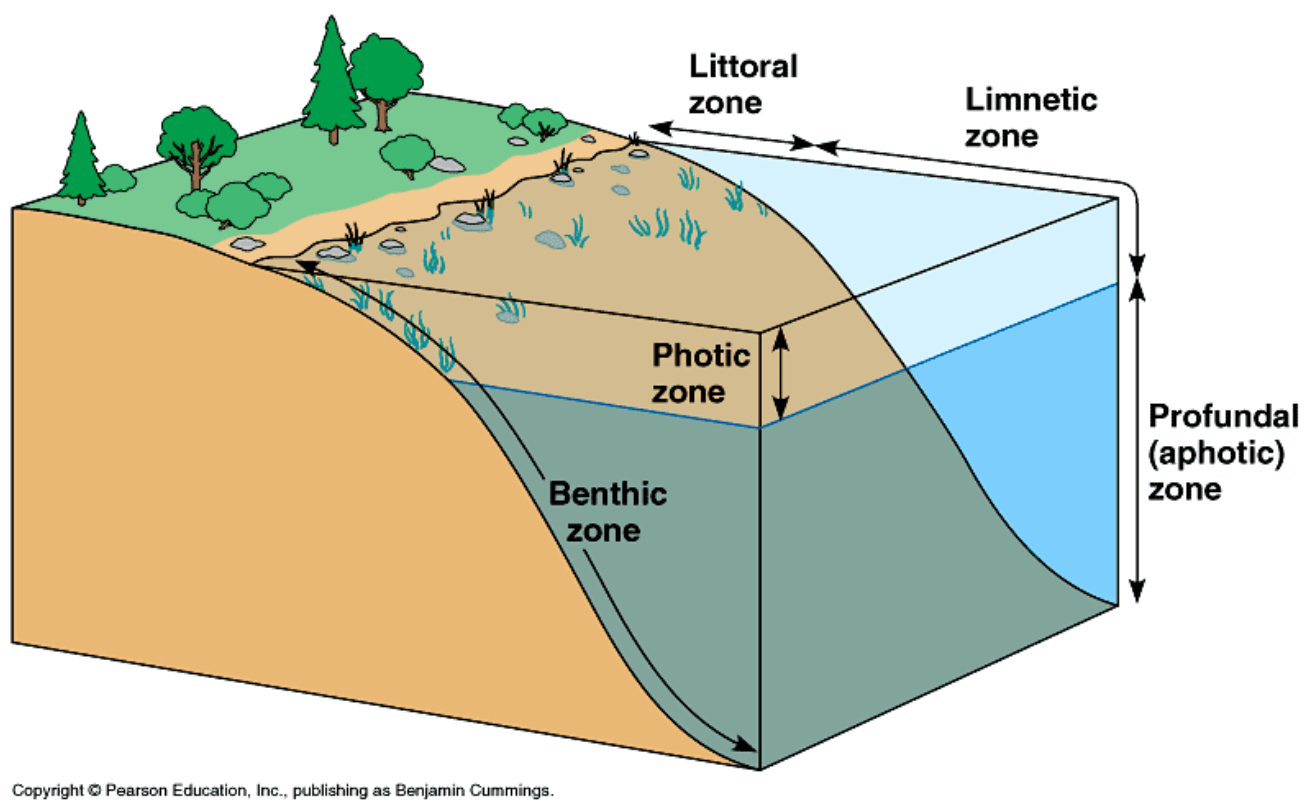
PART 1: Factors Contributing to Excessive Growth

B. Shallow Depths

1. The "photic zone" is the area of a water body where plants can photosynthesize
2. When the photic zone extends all the way to the bottom of a pond or lake, the entire water column is an adequate substrate for nuisance plants

PART 1:

Factors Contributing to Excessive Growth



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PART 1: Factors Contributing to Excessive Growth

C. Hot, Dry Weather

1. Hot weather contributes to lower dissolved oxygen levels, which makes it difficult for aerobic bacteria to consume excess nutrients and break down organic waste
2. During times of low precipitation, water bodies do not circulate and can become stagnant

PART 2:

Types of Nuisance Vegetation

PART 2: Types of Nuisance Vegetation

A. Submersed Plants

B. Emergent Plants

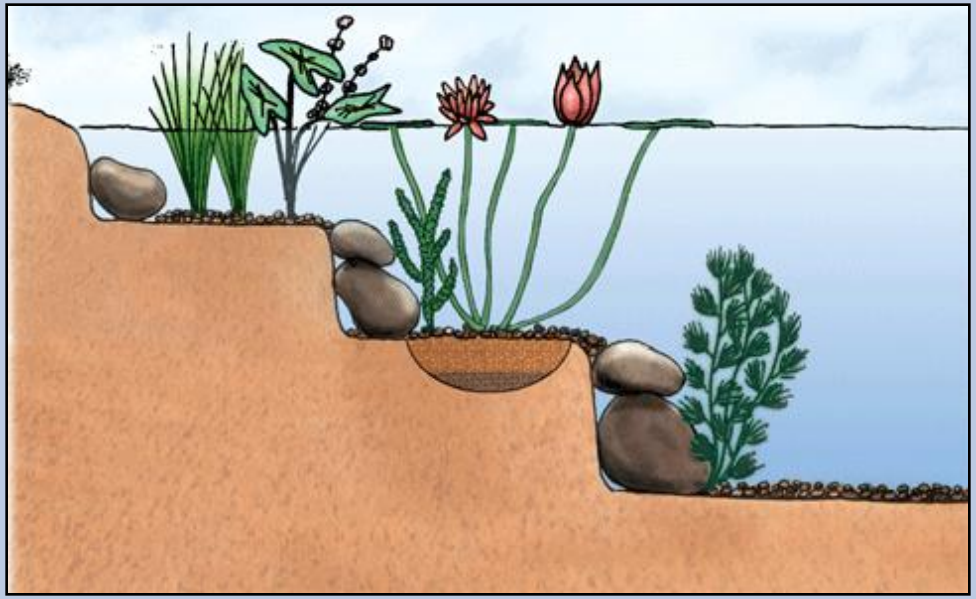
C. Floating Plants

D. Algae

PART 2: Types of Nuisance Vegetation

A. Submersed Plants

1. Grow completely beneath the water surface and depend on the water for support of the plant body



PART 2: Types of Nuisance Vegetation

A. Submersed Vegetation

Hydrilla (*Hydrilla verticillata*): Exotic; forms dense mats; reproduces by persistent tubers, turions, and fragmentation

PART 2: Types of Nuisance Vegetation

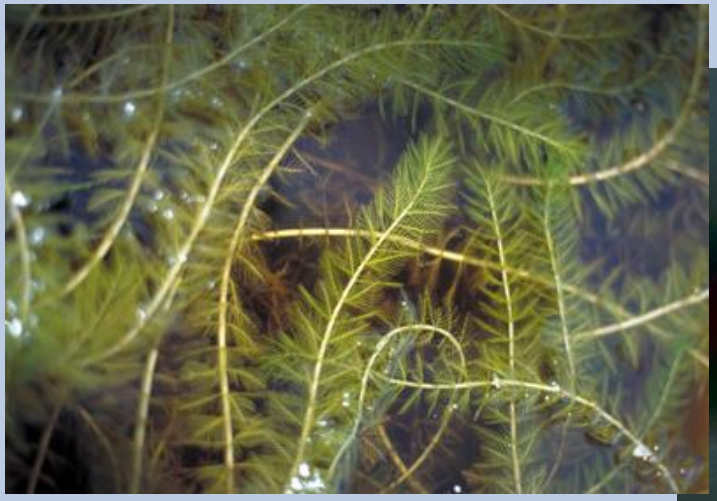
A. Submersed Vegetation

Brazilian elodea (*Egeria densa*): Exotic; forms dense mats; reproduces only by fragmentation of male plants

PART 2: Types of Nuisance Vegetation

A. Submersed Vegetation

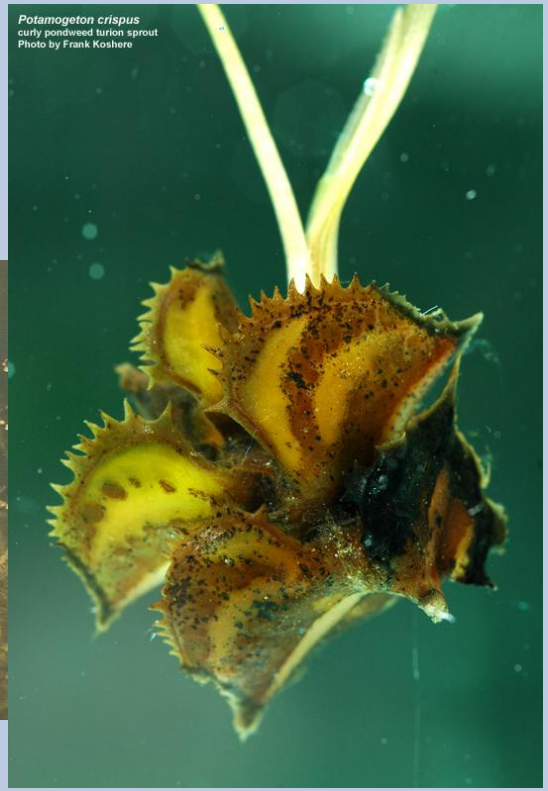
Eurasian watermilfoil (*Myriophyllum spicatum*): Exotic; tends to shade out other species; grows up to 20 feet long; winter hardy; reproduces by fragmentation and stolons



PART 2: Types of Nuisance Vegetation

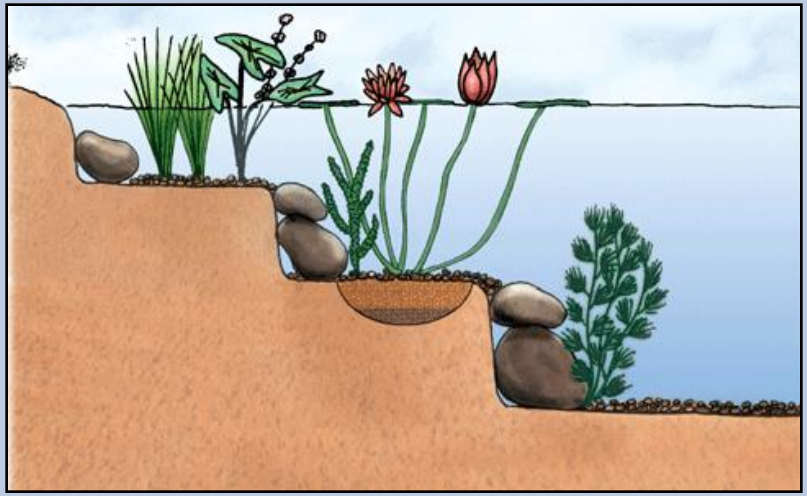
A. Submersed Vegetation

Curly-leaf pondweed (*Potamogeton crispus*): Exotic; very tolerant of turbid water; dies off in mid-summer; reproduces primarily by turions



B. Emergent Plants

1. Rooted to the bottom, but extend above the water surface and are self supporting



B. Emergent Vegetation

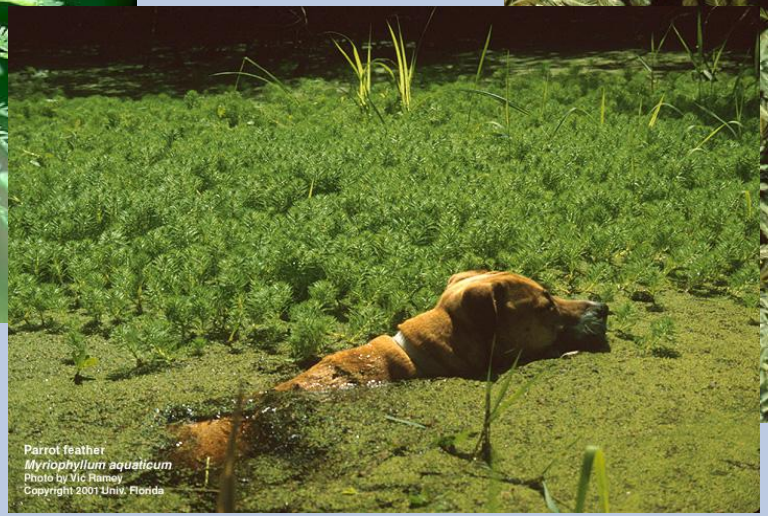
Cattails (*Typha latifolia and T. angustifolia*) – Native; excellent habitat plant, but VERY invasive; reproduces by rhizomes and seeds

B. Emergent Vegetation

Water primrose (*Ludwigia sp.*) – Exotic; VERY fast growing, sprawling growth habit; showy yellow flowers; reproduces prolifically by seeds

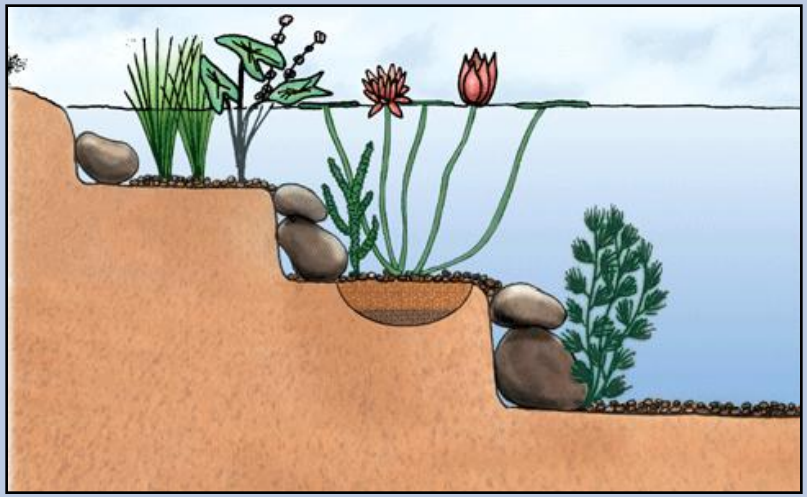
B. Emergent Vegetation

Parrotfeather (*Myriopyllum aquaticum*) – Exotic; VERY difficult to control; sprawling growth habit; reproduces by rhizomes and fragmentation



C. Floating Plants

1. Rooted on the bottom with floating leaves, or free-floating



C. Floating Plants

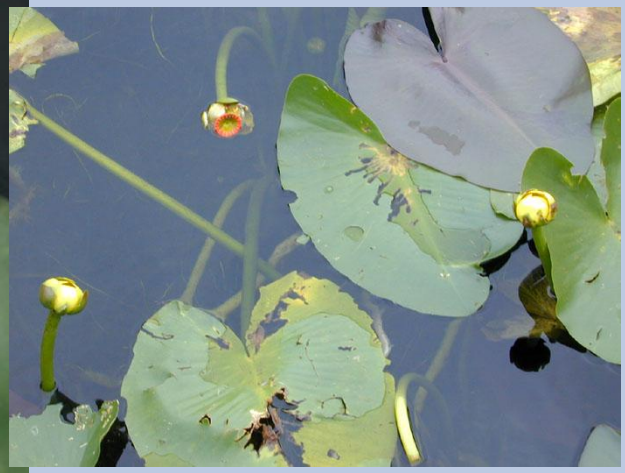
Watershield (*Brasenia schreberi*) – Native; can grow in water up to 6 feet deep; gelatinous slime on underside of leaf; reproduces by seeds and rhizomes

C. Floating Plants

White water lily (*Nymphaea odorata*) – Native; can grow in water up to 5 feet deep; flowers open early in the morning and close mid-day; reproduces by seeds and rhizomes

C. Floating Plants

Spatterdock (*Nuphar lutea spp.*) – Native; roots can be up to 6 inches in diameter; "half-opened" yellow flowers; reproduces by seeds and rhizomes



C. Floating Plants

Yellow floating heart (*Nymphoides peltata*) – Exotic; can grow in depths of up to 14 feet; spreads very rapidly; reproduces by seeds and rhizomes; **may be locally common around Rappahannock County

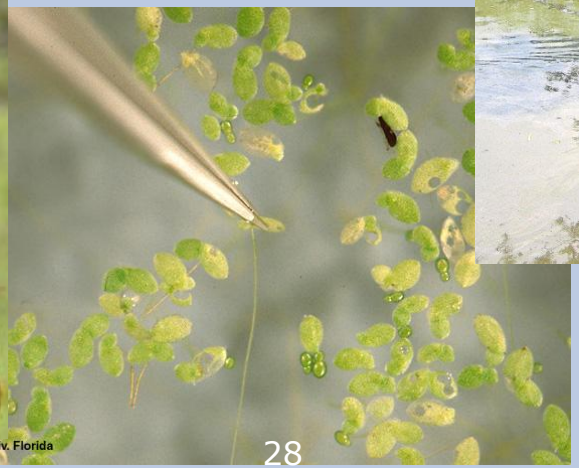
C. Floating Plants

Watermeal (*Wolffia spp.*) – Native; smallest seed-bearing plants in the world; reproduce rapidly by budding and can cover the entire surface of a pond within a few weeks

PART 2: Types of Nuisance Vegetation

C. Floating Plants

Duckweed (*Lemna spp.*) – Native; gets nutrients directly from water column through tiny roots; reproduce rapidly by budding and can cover the entire surface of a pond within a few weeks



PART 2: Types of Nuisance Vegetation

D. Algae

1. Simple plants with no vascular tissue; do not produce true roots, leaves, or flowers

PART 2: Types of Nuisance Vegetation

D. Algae

Filamentous algae (*Spyrogyra, Anabaena, Pithophora,* etc.)– Begins growth on the pond bottom; forms mats that rise to surface; looks like horse hair or "scum"

D. Algae

Planktonic algae *(Chlamydomonas, Euglena, Anacystis,* etc.*)*– Microscopic floating plants; desirable in moderate amounts (base of food chain); can appear as "green water" or surface "slime"

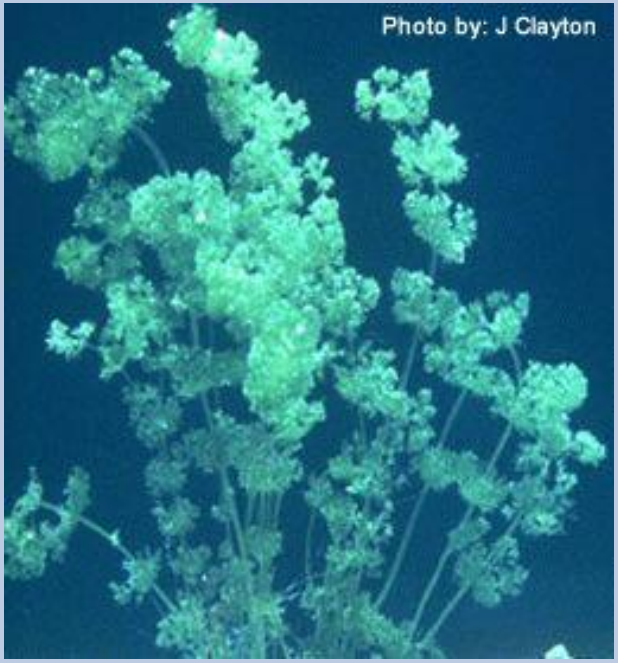
PART 2: Types of Nuisance Vegetation

D. Algae

Muskgrass (*Chara spp.*)– Branched, multicellular algae often confused with submersed flowering plants; has foul, musky odor and grainy texture

D. Algae

Stonewort (*Nitella spp.*)– Branched, multicellular algae often confused with submersed flowering plants; soft and bushy with no odor



PART 3:

Management Strategies

PART 3: Management Strategies

A. Biological Control
B. Mechanical Harvest
C. Physical Practices
D. Cultural Control
E. Aeration
F. Chemical Herbicides

PART 3: Management Strategies

A. Biological Control

1. Triploid Grass Carp
2. Beneficial Water Quality Augmentation

PART 3: Management Strategies

B. Mechanical Harvest

PART 3: Management Strategies

C. Physical Practices

1. Dredging
2. Shading/Light Attenuation

PART 3: Management Strategies

D. Nutrient Management

1. Avoid Fertilizer Use
2. Vegetated Buffers
3. Livestock Exclusion

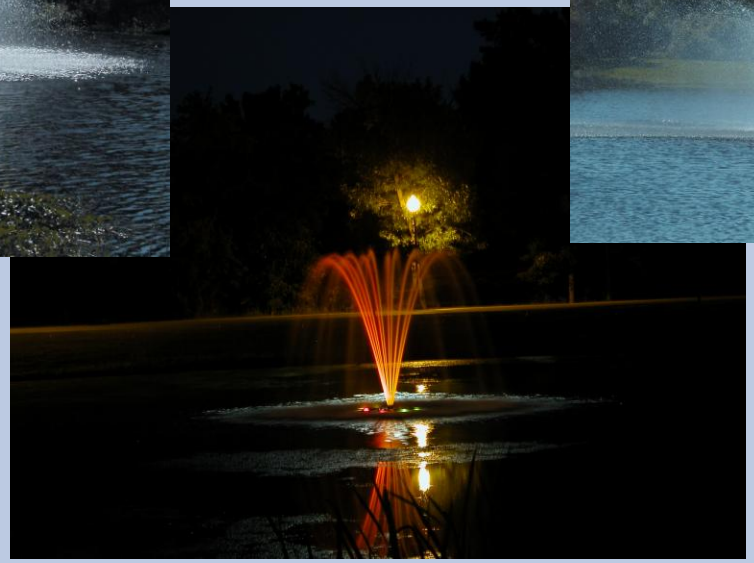
PART 3: Management Strategies

E. Aeration

1. Encourages the growth of beneficial bacteria, which help to utilize excess nutrients and break down decaying organic matter
2. Discourages thermal stratification and helps ensure adequate oxygen levels throughout the water column
3. BONUS: Creates open water areas in winter for waterfowl

PART 3: Management Strategies

Floating Fountains – The spray droplets add oxygen to the water column and create wave action, which promotes circulation



PART 3: Management Strategies

Diffused Air Systems – Air bubbles lift hypoxic bottom water to surface and create circulation pattern of entire water column

F. Chemical Control

PART 3: Management Strategies

F. Chemical Control

Glyphosate (AquaPro®, Rodeo®, Pondmaster®)

- Systemic herbicide; translocated from leaves through entire plant and roots
- Non-selective/broad-spectrum; applied as foliar spray at late growth stages
- Effective on emergent and floating-leaf species
- Application rate is .75% to 1.5% solution (1-4 quarts/acre)
- In water, glyphosate is strongly adsorbed to soil particles and mineral matter and becomes inert (12-day to 10-week half-life)
- No restrictions for swimming, fishing, livestock watering, or irrigation at label rates
- DO NOT use Round-Up in aquatic applications – tallow amine surfactant is toxic to fish!!

PART 3: Management Strategies

F. Chemical Control

Chelated Copper (Captain®, Cutrine Plus®)

- Contact algaecide; effective on chara, nitella, and filamentous and planktonic algae
- Much more effective than copper sulfate at lower rates
  - Higher pH and stronger chemical bond
  - Stays in solution longer = longer contact time
  - 90% of $CuSO_4$ binds to carbonate and becomes unavailable
  - Far less elemental copper introduced to aquatic environment
- Application rate is .2 to 2.4 ppm copper
- No restrictions for swimming, fishing, livestock watering, or irrigation at label rates

PART 3: Management Strategies

F. Chemical Control

Fluridone (Sonar®, Avast!®, Whitecap®)

- Systemic herbicide; Carotenoid inhibitor that allows chlorophyll in plants to be damaged by sunlight
- Effective on submersed weeds and many floating species
- Selective by plant tolerance levels and time of application
- Effective concentration is 6 to 90 ppb*(!)*
- Requires >60 day exposure time to be effective; concentration of active ingredient should be monitored by chemical assay
- Breaks down in environment by sunlight degradation (30-day half-life)
- No restrictions for swimming, fishing, or livestock watering at label rates
- Does have irrigation restrictions

PART 4:

Case Study

Summerwood Pond, Loudoun County, VA 2001-2009

BEFORE Maintenance Program

PART 4: Case Study - Before

Fish Kill, DO = <2.0 mg/L

PART 4: Case Study - Before

Heavy Algal Growth

PART 4: Case Study - Before

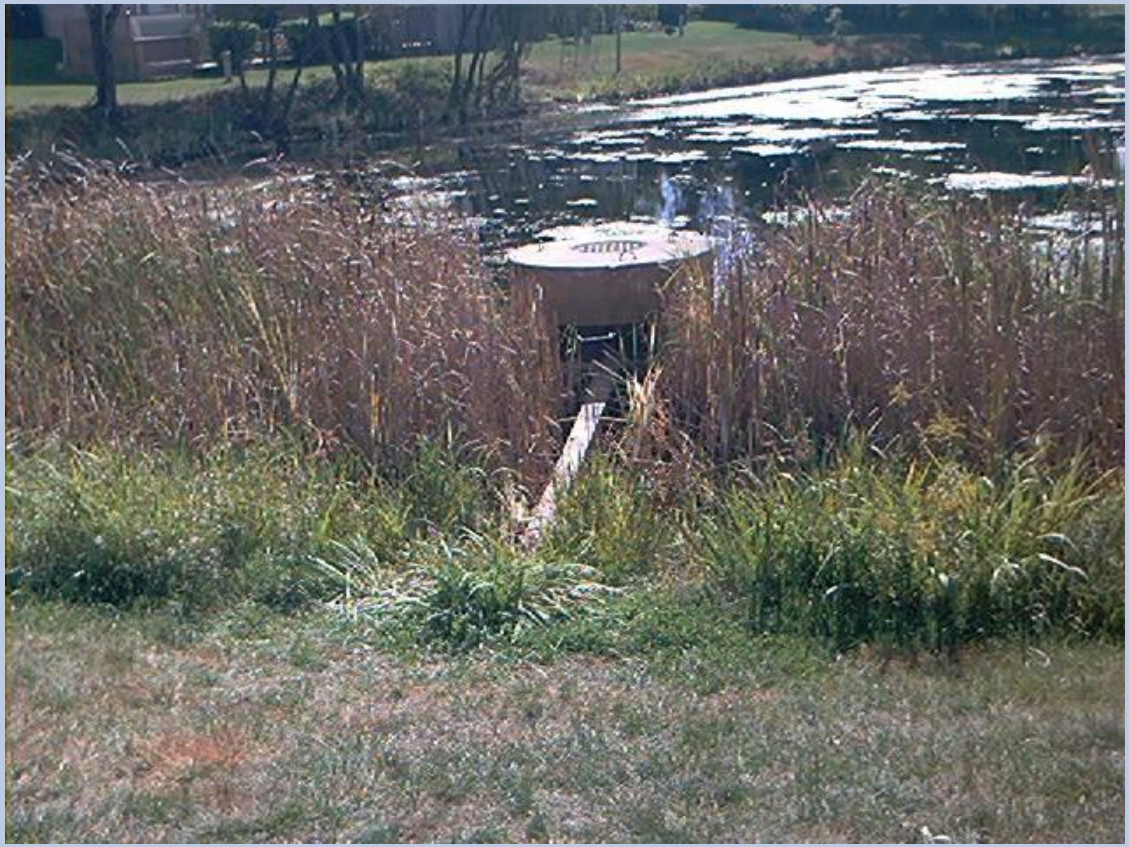
Unpleasant Stench

PART 4: Case Study - Before

Unstabilized and Eroding Shoreline

PART 4: Case Study - Before

Excessive Cattail Growth



Implementation of Maintenance Program

PART 4: Case Study - Implementation

Herbicide Applications – Algae & Brittle Naiad

PART 4: Case Study - Implementation

Cattail Harvest & Treatment

PART 4: Case Study - Implementation

Biolog Installations

PART 4: Case Study - Implementation

Seedling Plug Installations

PART 4: Case Study - Implementation

Planting Success!

PART 4: Case Study - Implementation

Fountain Installation

Finally . . .