

Applied Perspectives Regarding Nutrient Pollution and Internal Loading Reductions in Waterways



Emily Reed
Integrated Lakes Management

Applied Perspectives Regarding Nutrient Pollution and Internal Loading Reductions in Waterways

Causes of nutrient pollution



Consequences of nutrient pollution



Strategies for reducing internal loading



Maintaining high water quality



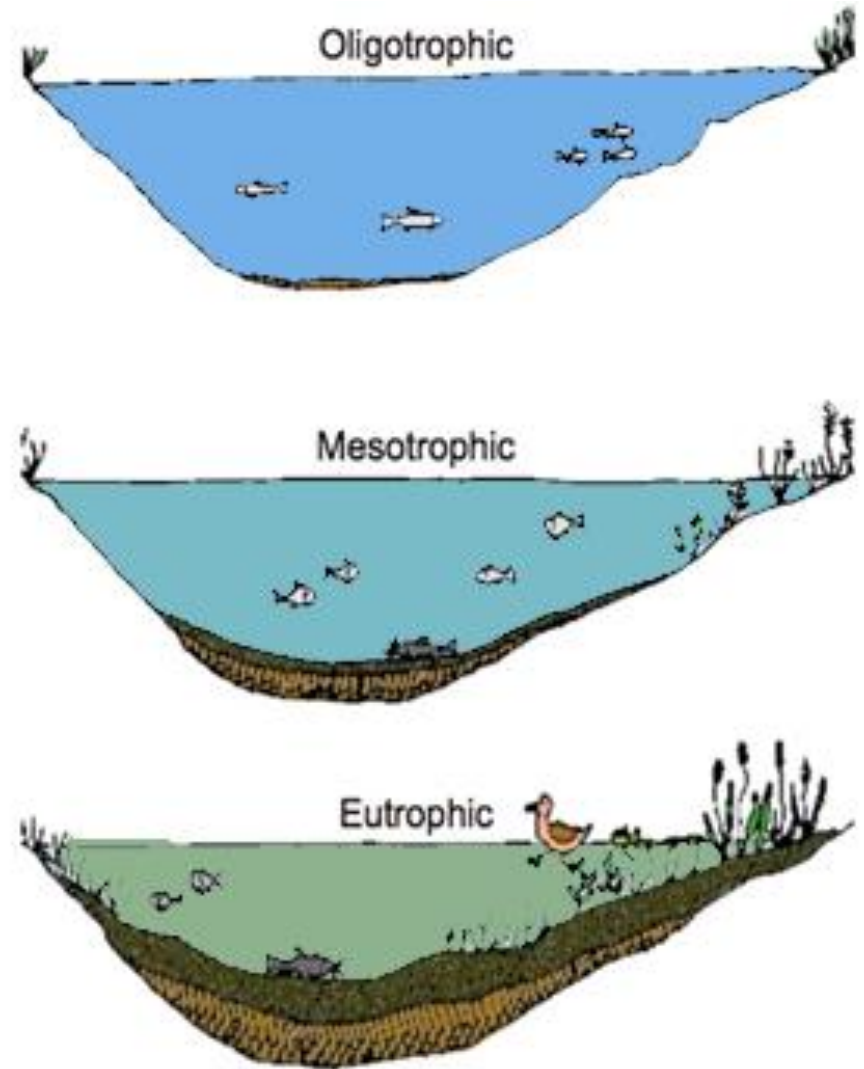
Causes of Nutrient Pollution

Aging in **natural** lakes

- 1000's of years from oligotrophic to mesotrophic
- 100's of years from mesotrophic to eutrophic

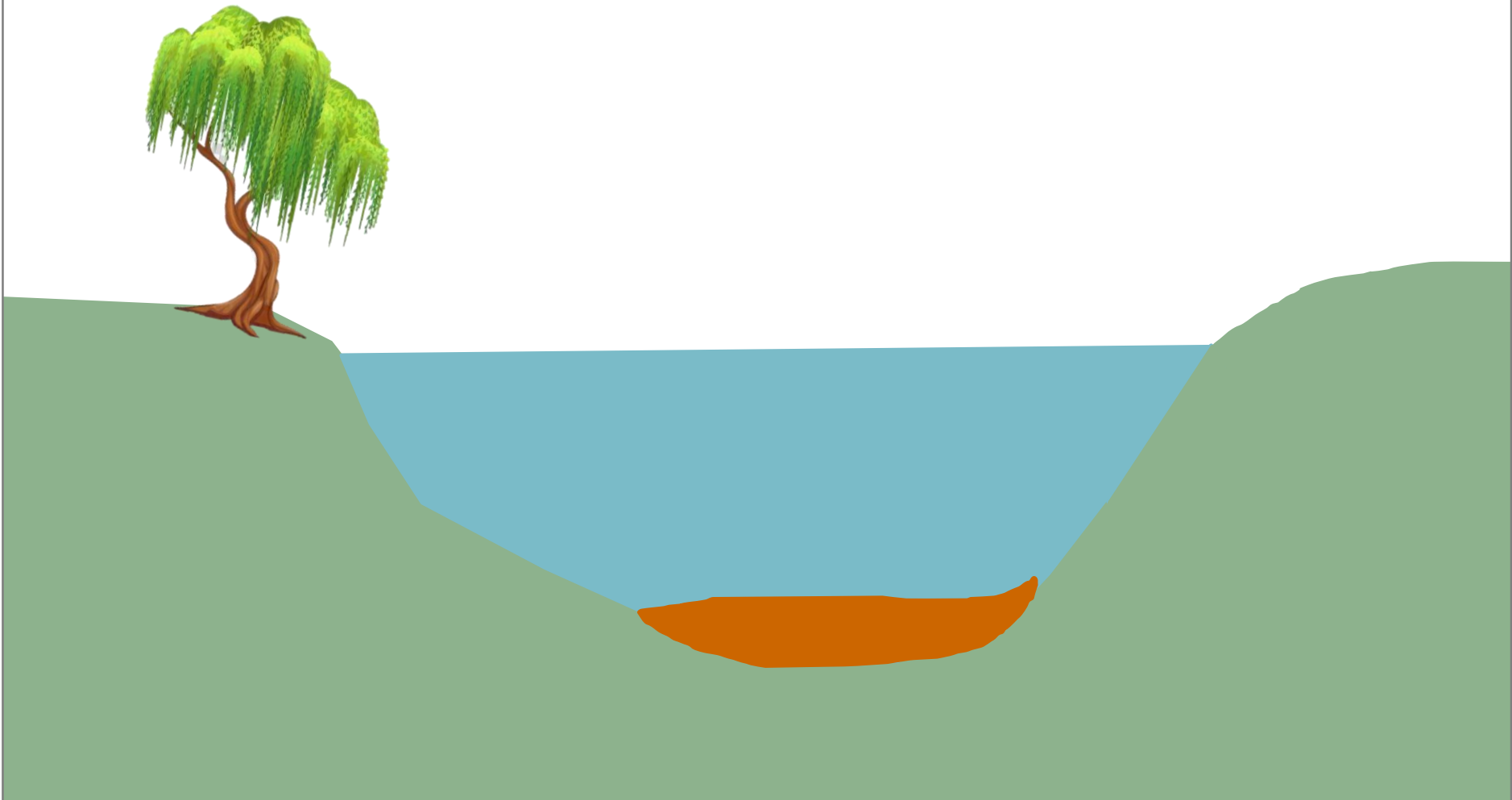
Aging in **manmade** lakes

- 10's of years from oligotrophic to eutrophic/hypereutrophic



Causes of Nutrient Pollution

Erosion

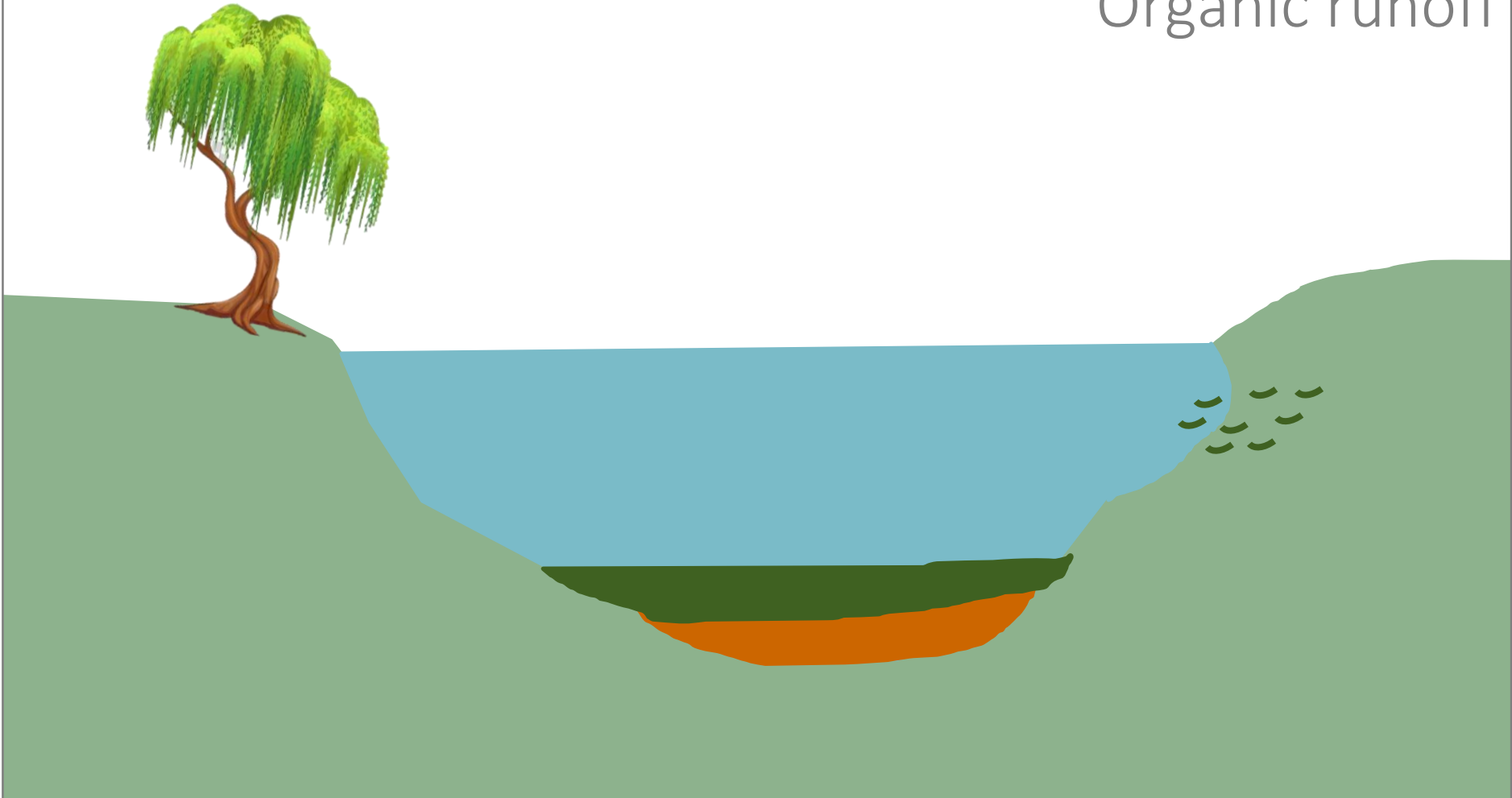


Causes of Nutrient Pollution



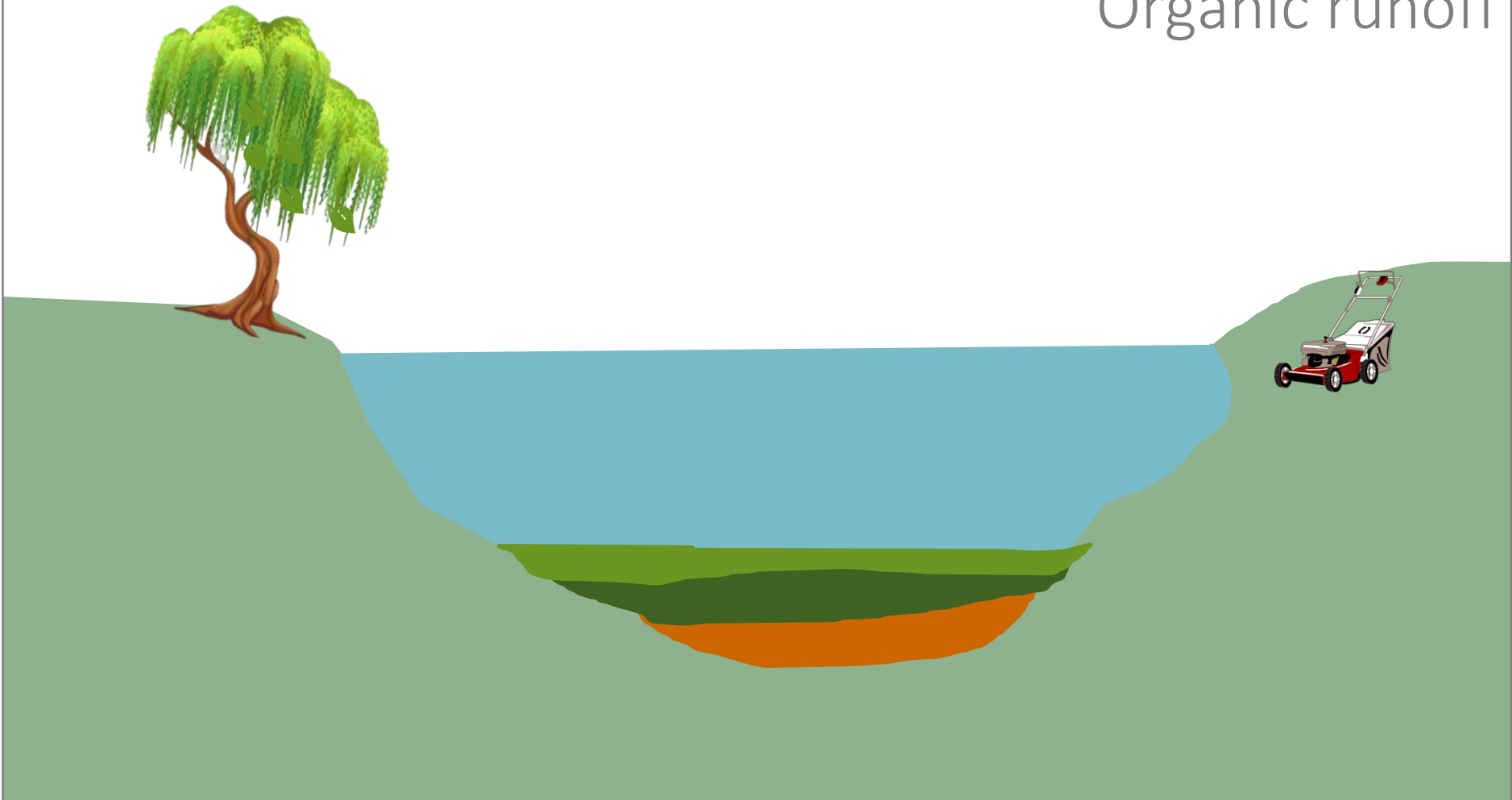
Causes of Nutrient Pollution

Erosion
Organic runoff



Causes of Nutrient Pollution

Erosion
Organic runoff



Causes of Nutrient Pollution

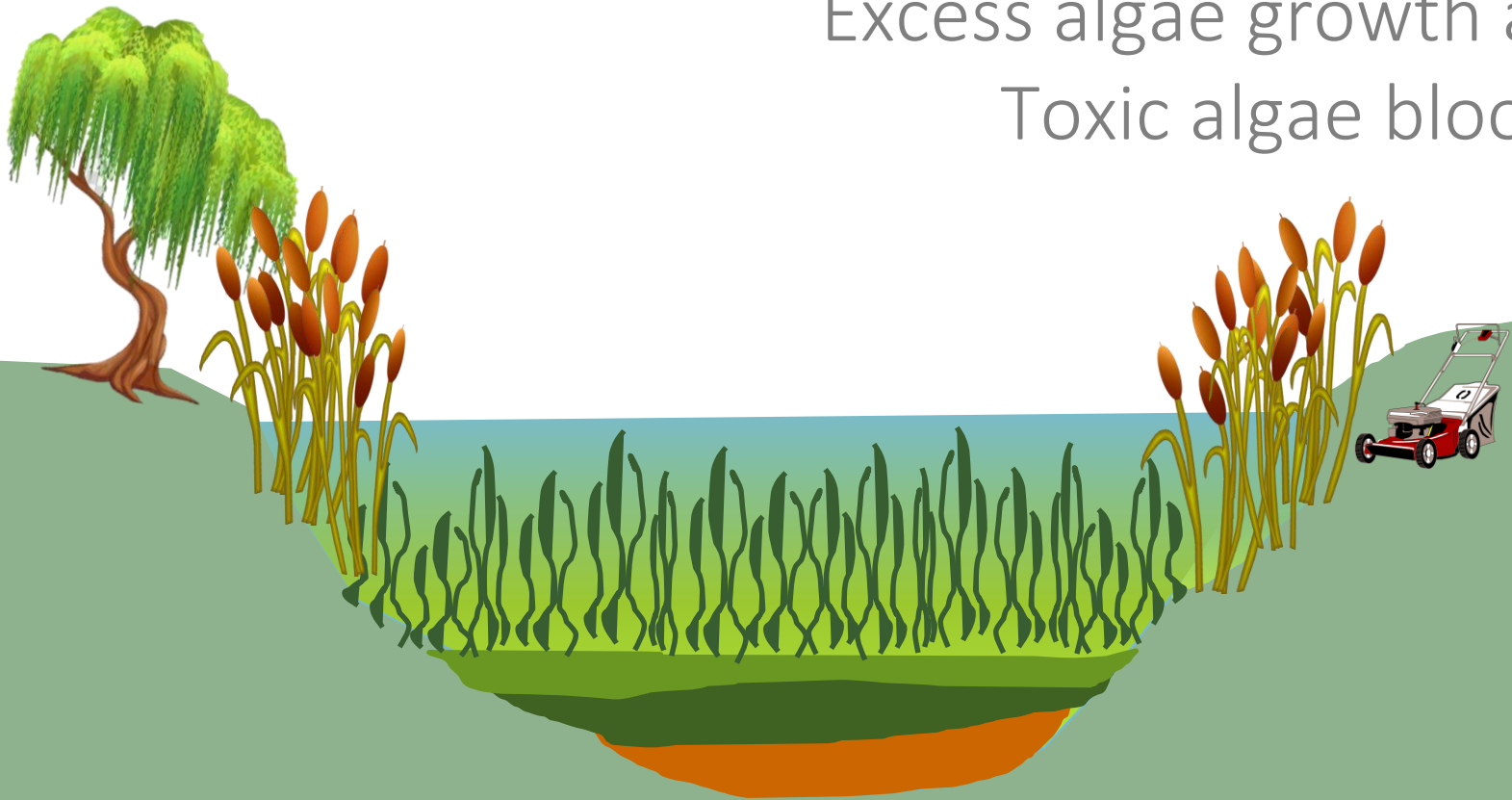
WHAT HAPPENS IN YOUR YARD OFTEN ENDS UP IN OUR LAKES AND RIVERS



One bushel of grass clippings can create 30 to 50 pounds of algae in the nearest lake or river.

source: North Central Wisconsin Storm Water Coalition and a Northeast Wisconsin Storm Water Consortium

Increases in nuisance plant growth
Excess algae growth and
Toxic algae blooms



Consequences of Nutrient Pollution

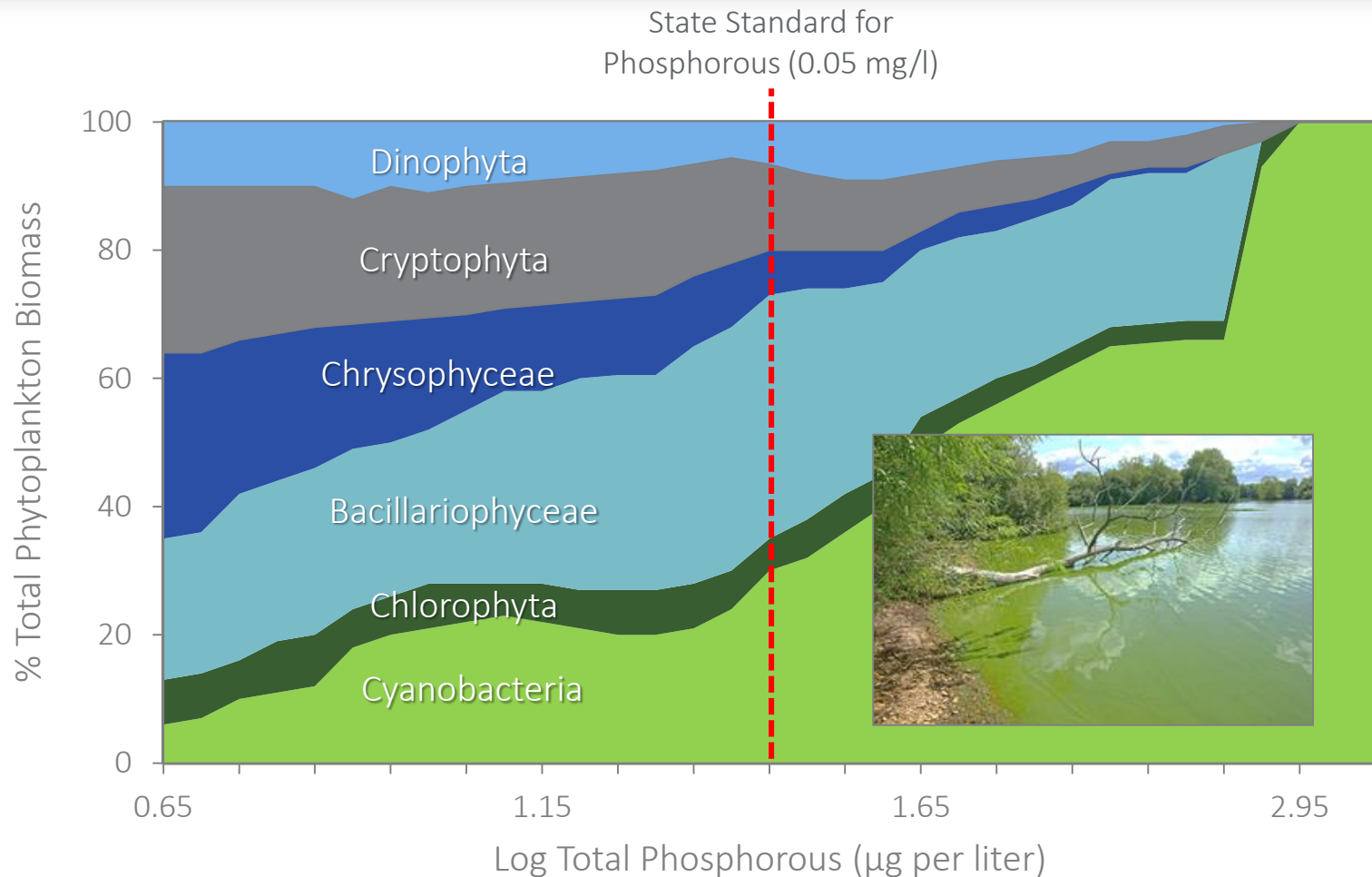
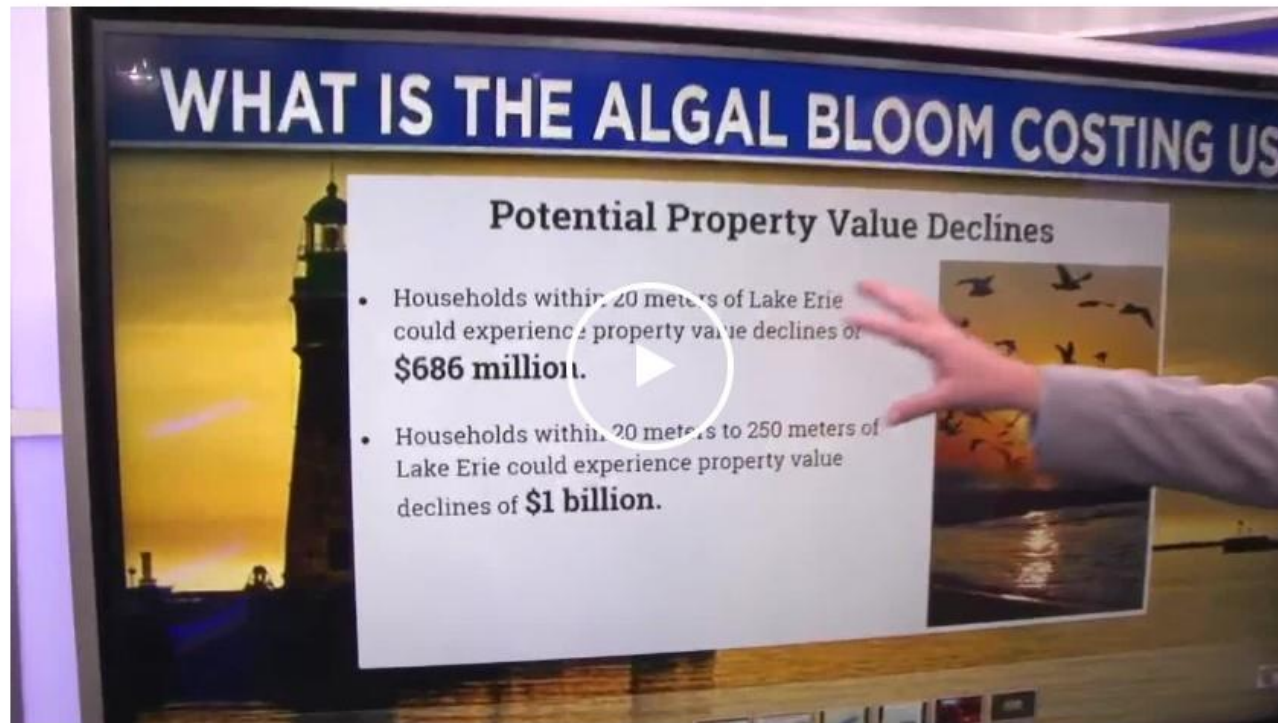


Figure adapted from Watson et al. Patterns in phytoplankton taxonomic composition across temperate lakes of differing status. 1997.

NEWS

Lake Erie algal blooms are costing tax payers millions, could stretch into billions

New study shows impacts to treatment plants, recreation and property values.



Lake Erie algal blooms are costing tax payers millions, could stretch into billions

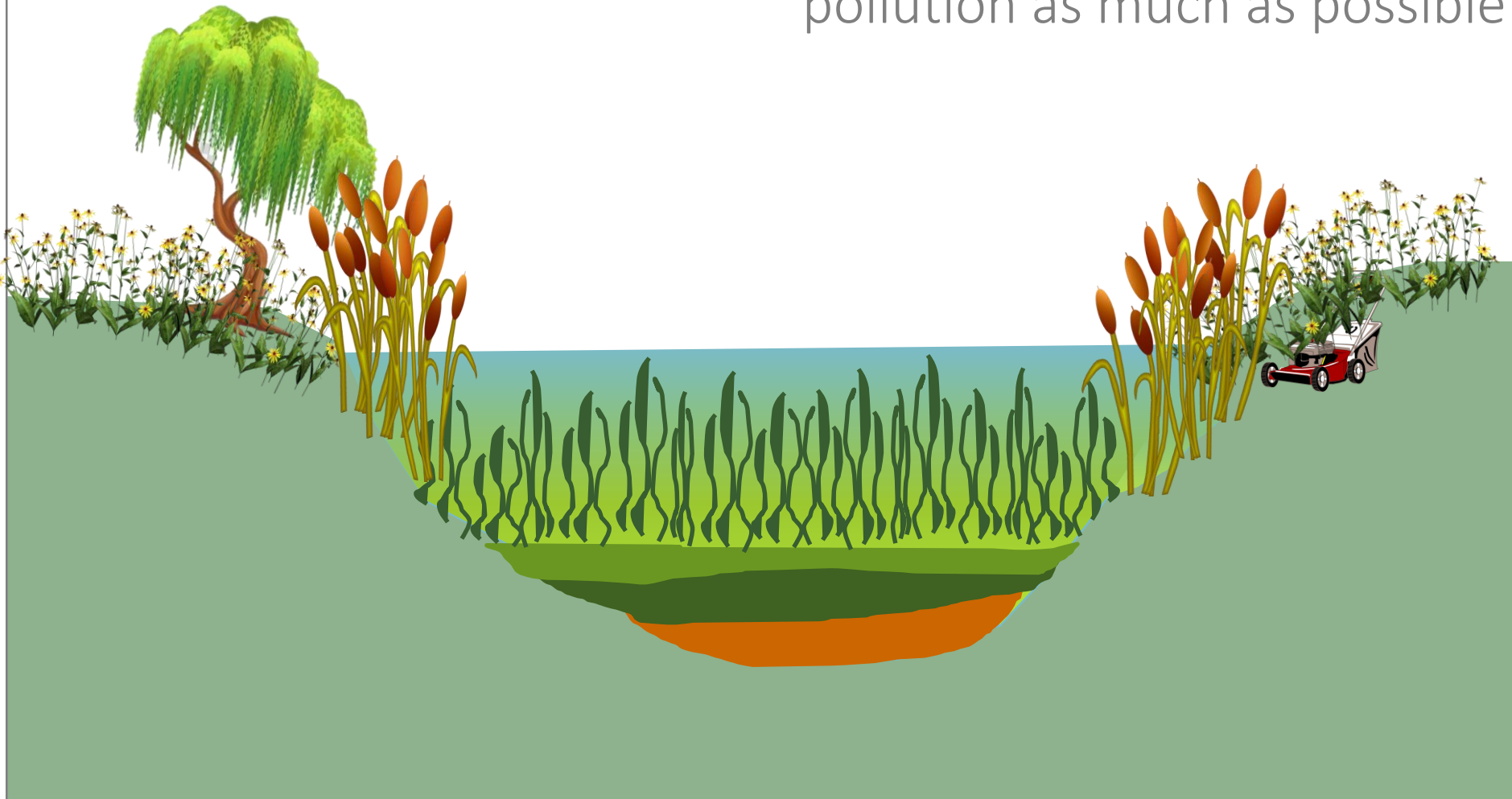
By [Dan DeRoos](#) | August 14, 2019 at 1:49 PM EDT - Updated August 14 at 6:25 PM

the lake's southwest region, where algae tends to accumulate. Image: MERIS/NASA, processed by

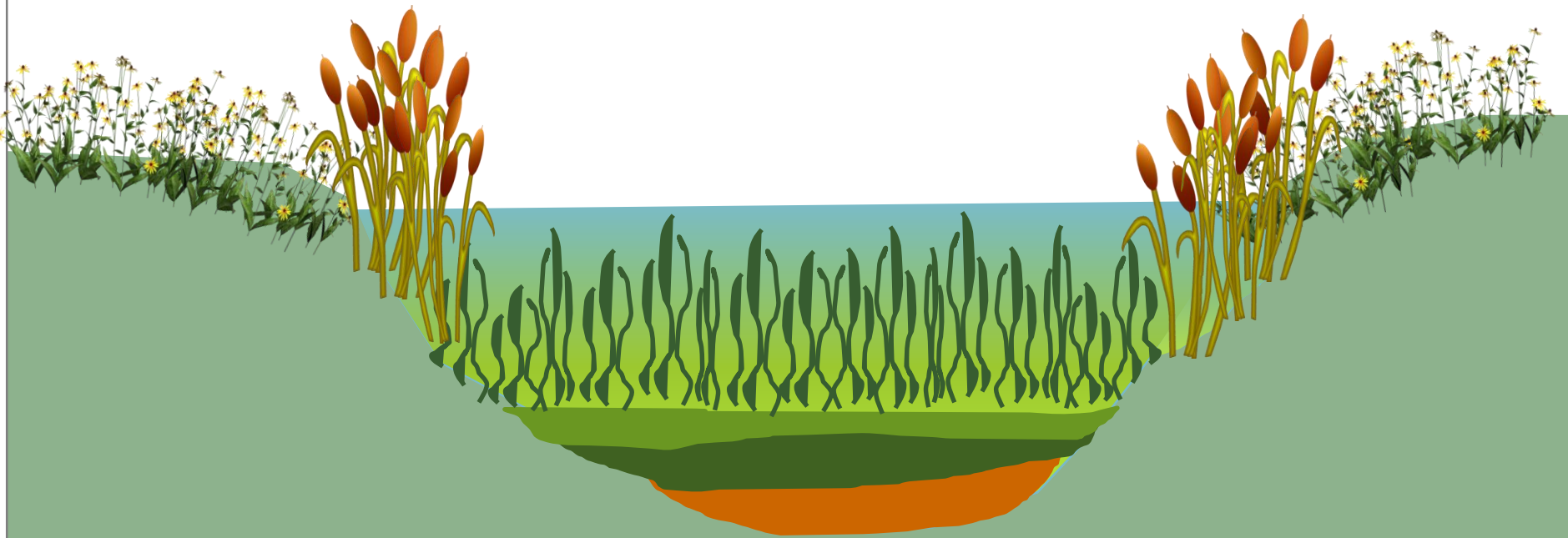
Start with water quality monitoring



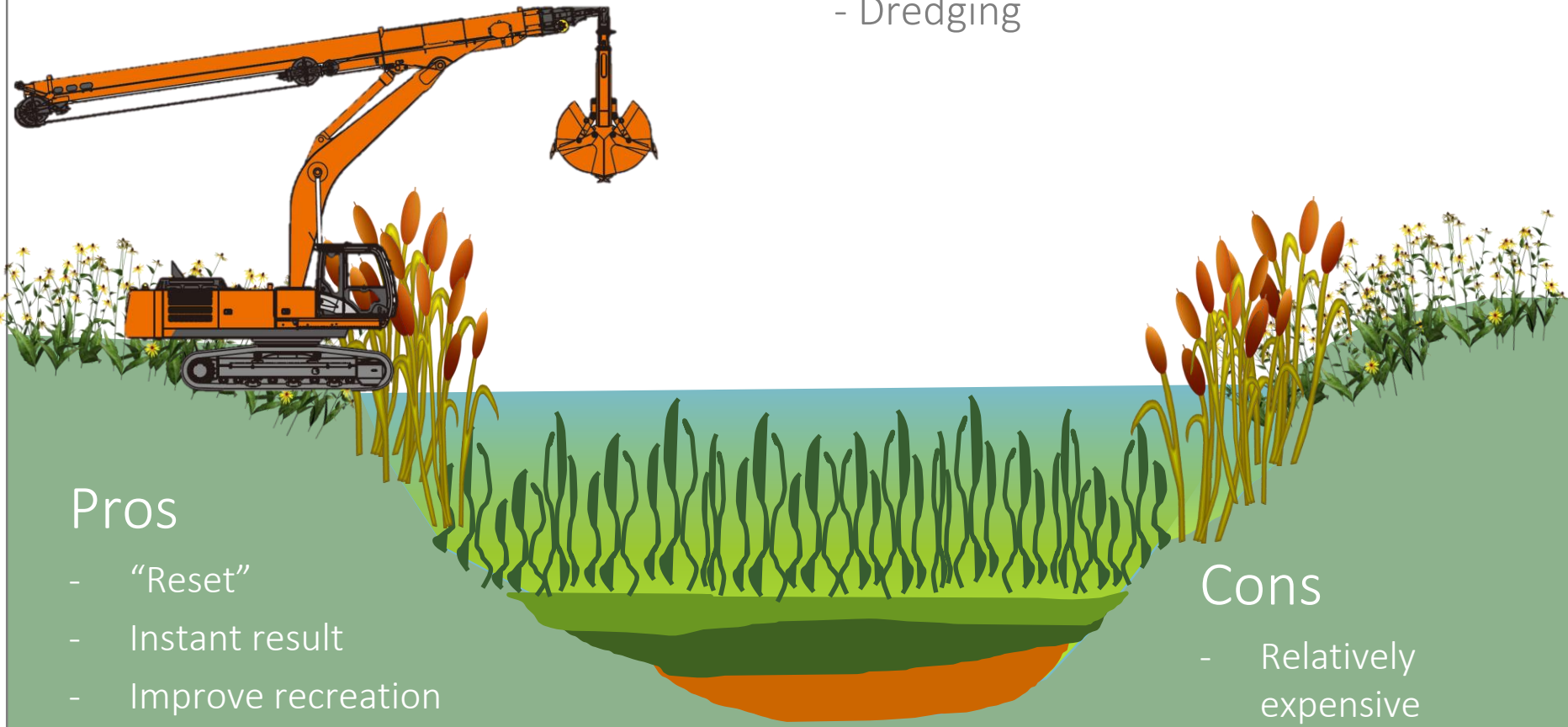
1. Reduce external sources of nutrient pollution as much as possible



1. Reduce external sources of nutrient pollution as much as possible
2. Reduce internal nutrient levels



1. Reduce Nutrients in Sediment - Dredging



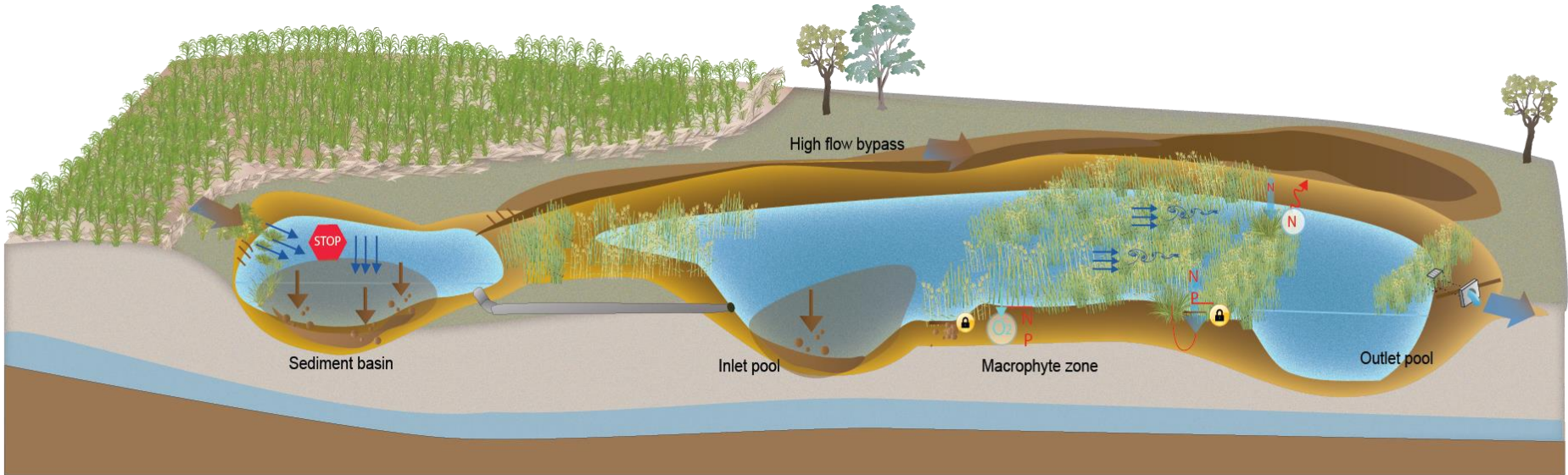
Pros

- “Reset”
- Instant result
- Improve recreation
- Reduce seed bank, increase depth
- Improve fish habitat

Cons

- Relatively expensive
- High impact
- Permitting (Time)

Sediment forebay to reduce dredging costs and lower impact





1. Reduce Nutrients in Sediment

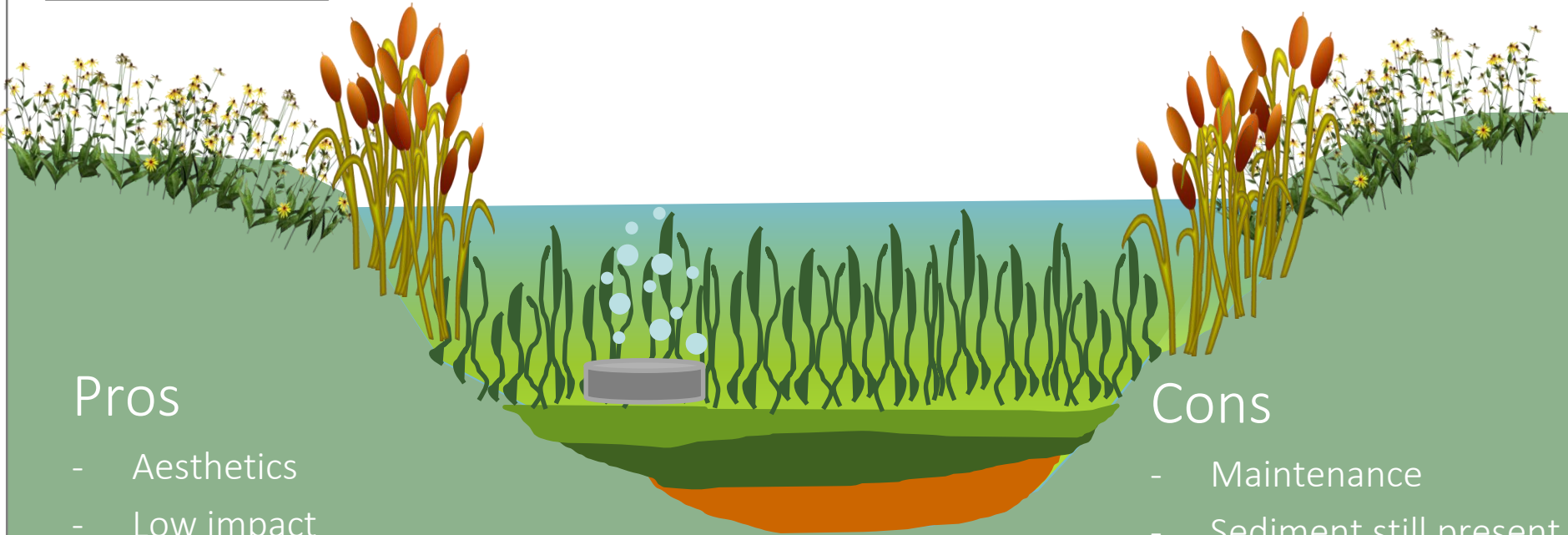
- Dredging
- Aeration

Pros

- Aesthetics
- Low impact
- Benefits for aquatic life
- Relatively inexpensive

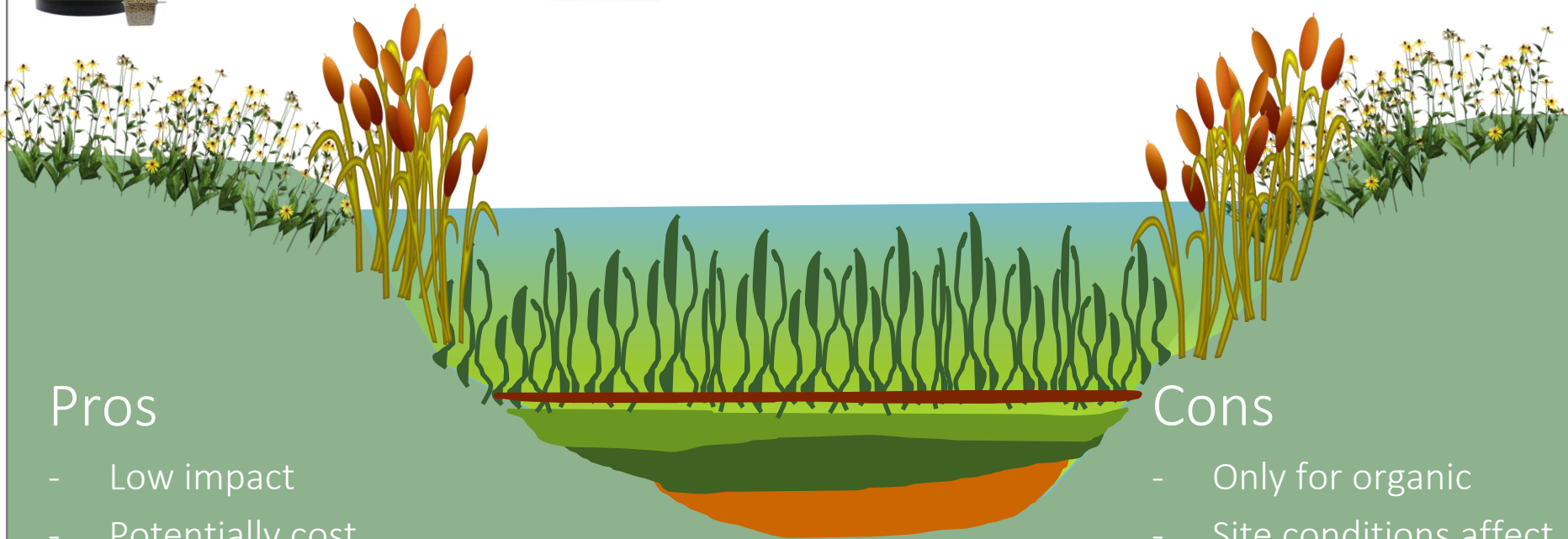
Cons

- Maintenance
- Sediment still present
- Need hookup
- Hard to scale up



1. Reduce Nutrients in Sediment

- Dredging
- Aeration
- Bacteria and Enzymes



Pros

- Low impact
- Potentially cost effective

Cons

- Only for organic
- Site conditions affect results



1. Reduce Nutrients in Sediment

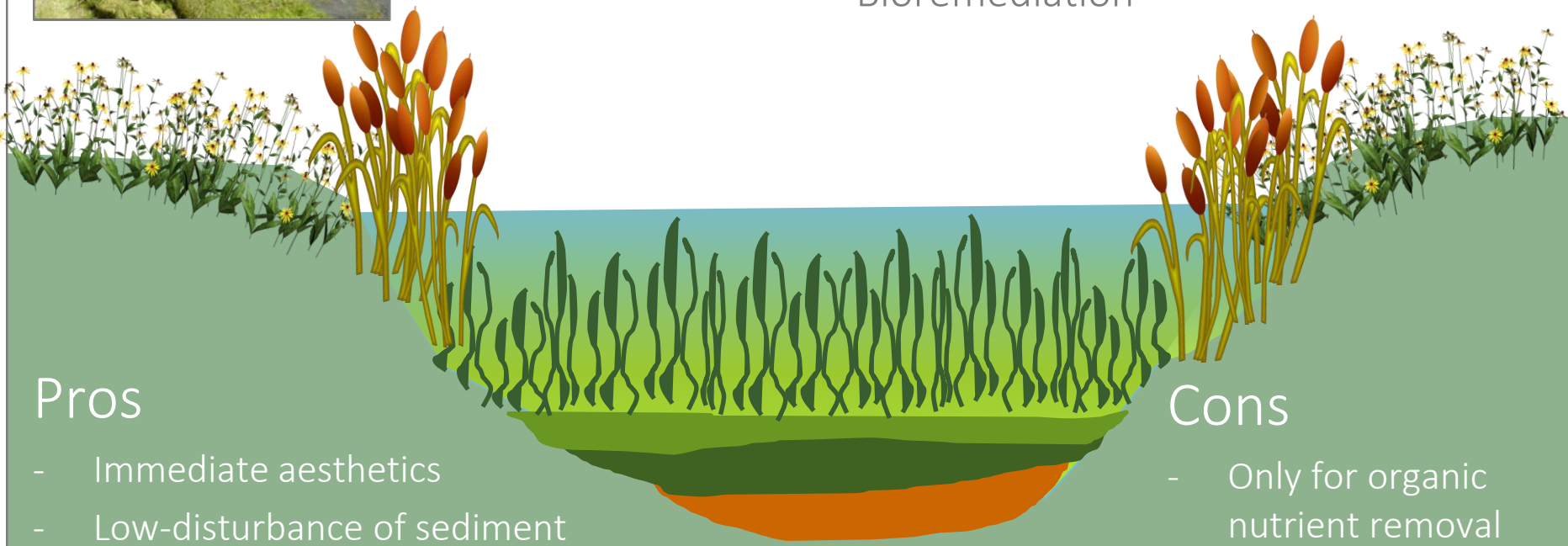
- Dredging
- Aeration
- Bacteria and Enzymes
- Bioremediation

Pros

- Immediate aesthetics
- Low-disturbance of sediment
- Potential heavy metal removal

Cons

- Only for organic nutrient removal
- Many visits needed
- Material disposal





1. Reduce Nutrients in Sediment

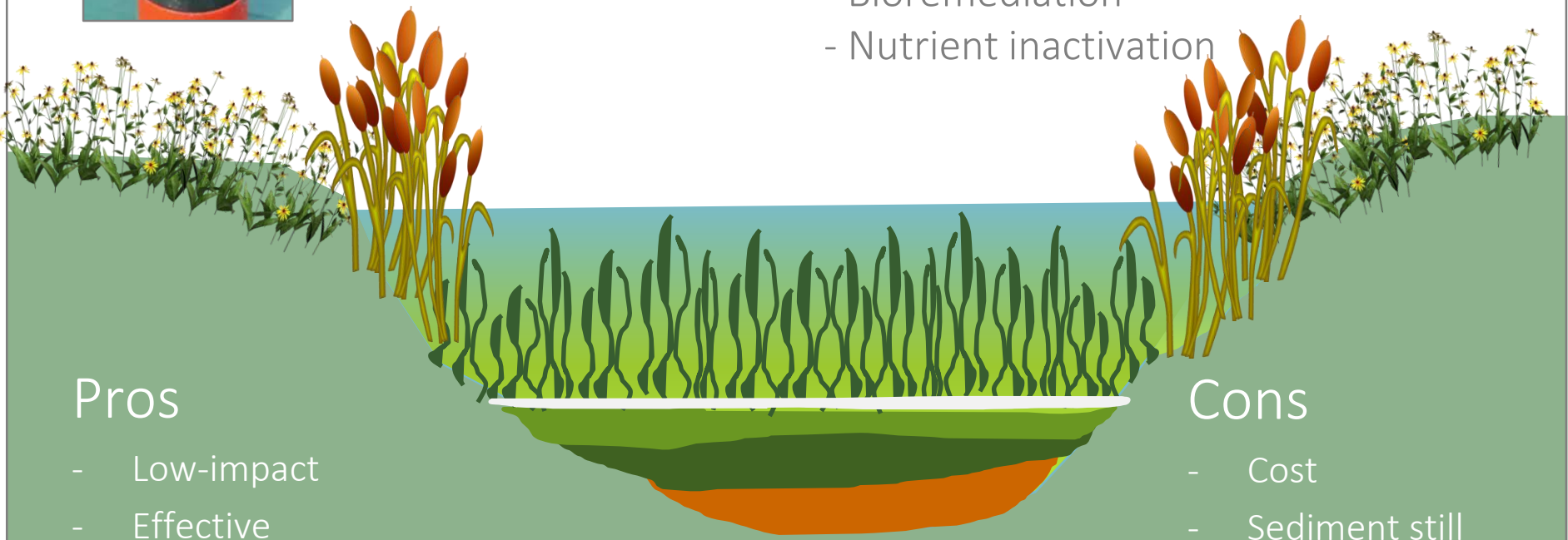
- Dredging
- Aeration
- Bacteria and Enzymes
- Bioremediation
- Nutrient inactivation

Pros

- Low-impact
- Effective
- Cost

Cons

- Cost
- Sediment still present
- Environmental



Method	Pro	Con
Dredging	Effective, Removes material, “Reset”, Improve habitat	Expensive, High impact, Permitting
Aeration	Aesthetics, Low impact, Relatively inexpensive	Maintenance, Energy costs, Sediment still present
Bacteria and Enzymes	Low impact, Cost-effective	Mixed results, Site specific
Bioremediation	Aesthetics	Time, Material disposal, Site specific
Nutrient Inactivation	Low Impact, Effective	Sediment still present

1. Reduce Nutrients in Sediment
2. Reduce Nutrients in Water
 - Nutrient Inactivation



Pros

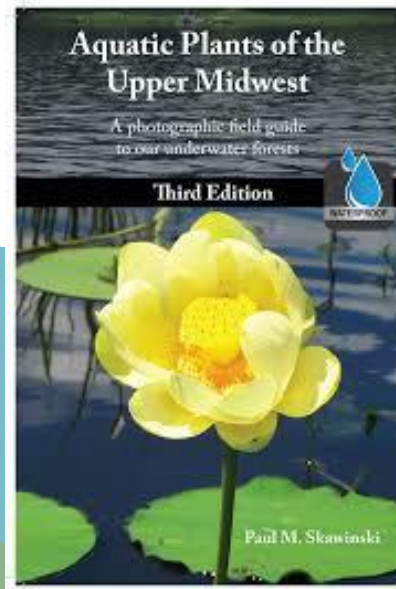
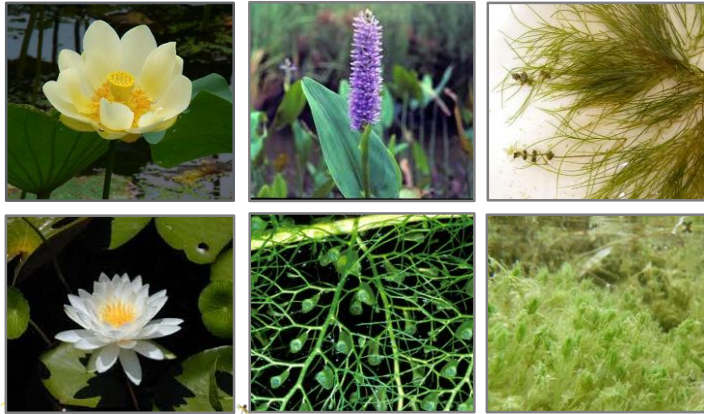
- Low-impact
- Effective

Cons

- Cost
- Environmental

Strategies for Reducing Internal Loading

1. Reduce Nutrients in Sediment
2. Reduce Nutrients in Water
 - Nutrient Inactivation
 - Promote desirable vegetation



Pros

- Ecologically beneficial
- Aesthetics
- Reduce algae overgrowth

Cons

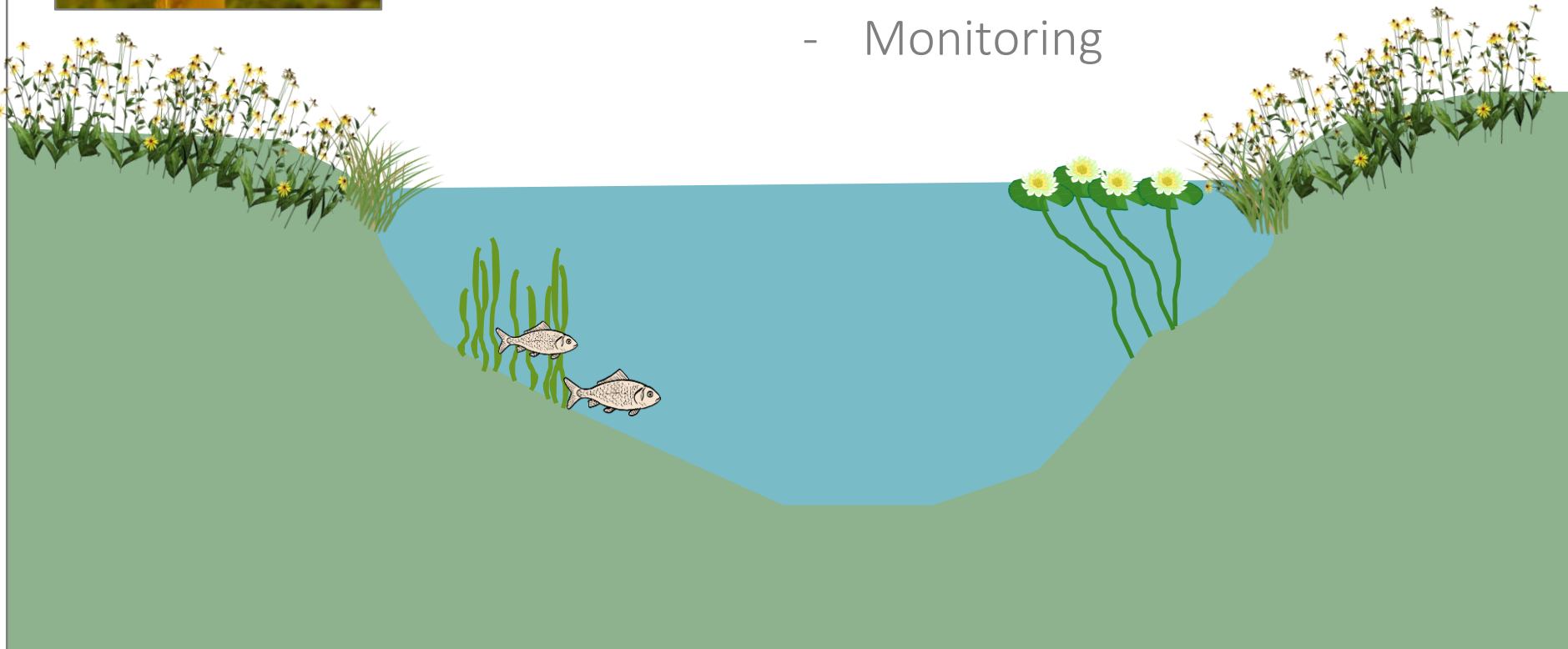
- Public perception
- Maintenance



Maintaining High Water Quality



- Continue reductions in nutrient inputs
- Community outreach
- Preparing for maintenance
- Monitoring



Causes of nutrient pollution



Consequences of nutrient pollution



Strategies for reducing internal loading



Maintaining high water quality



Thank you!



ereed@ilmenvironments.com