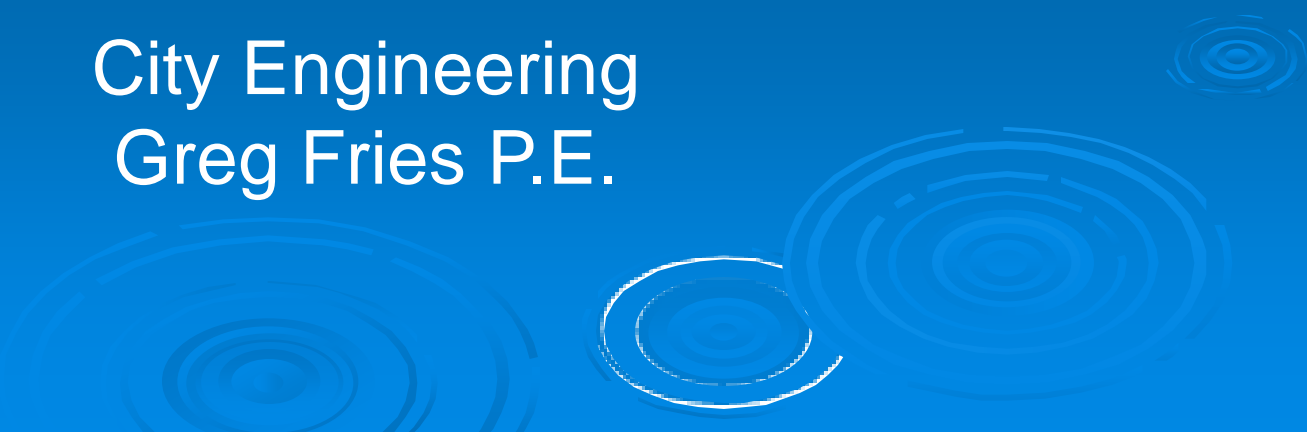


URBAN STORMWATER

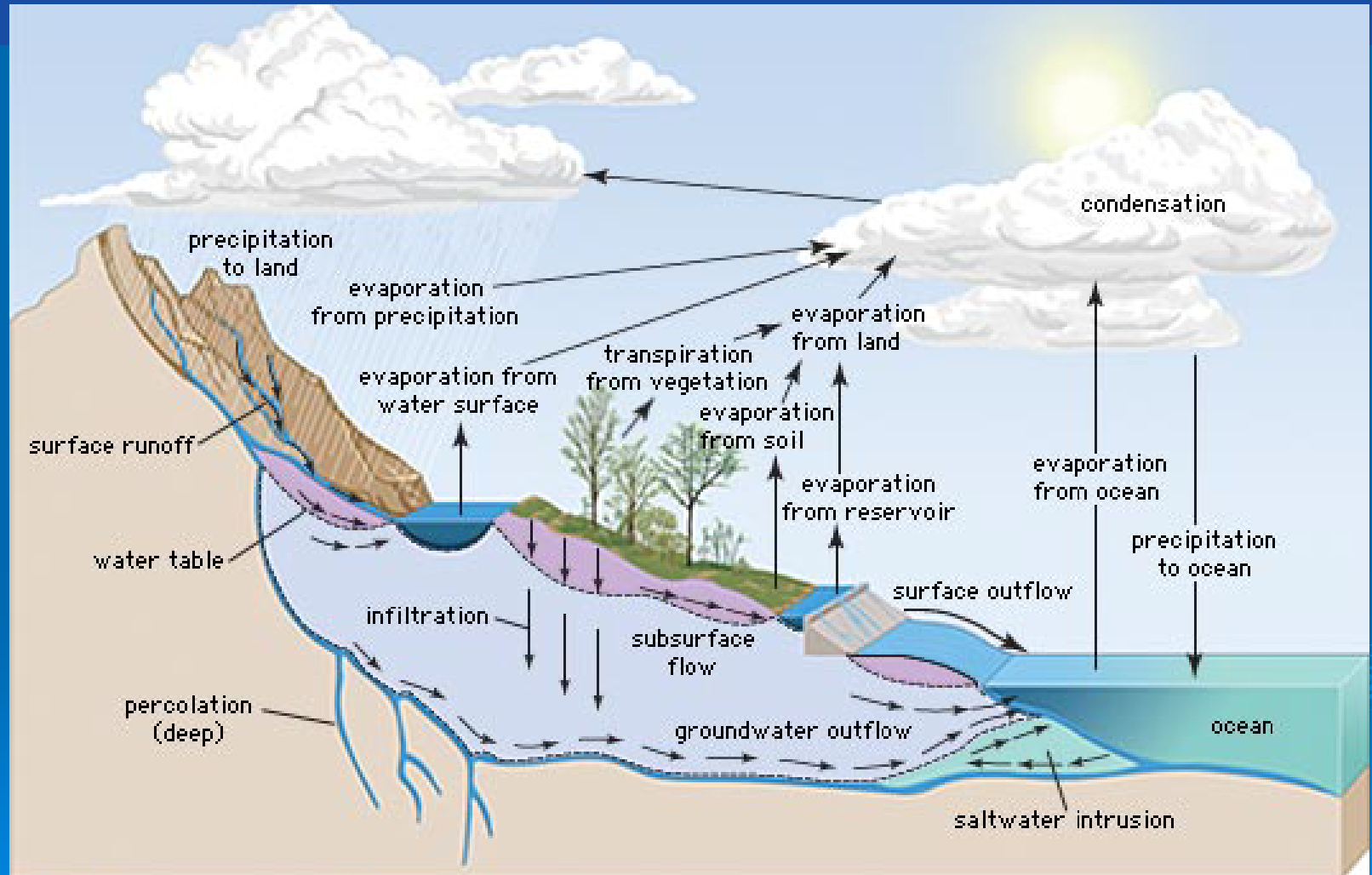
What you (may) want to know

City Engineering
November, 2014

City Engineering
Greg Fries P.E.



Basics

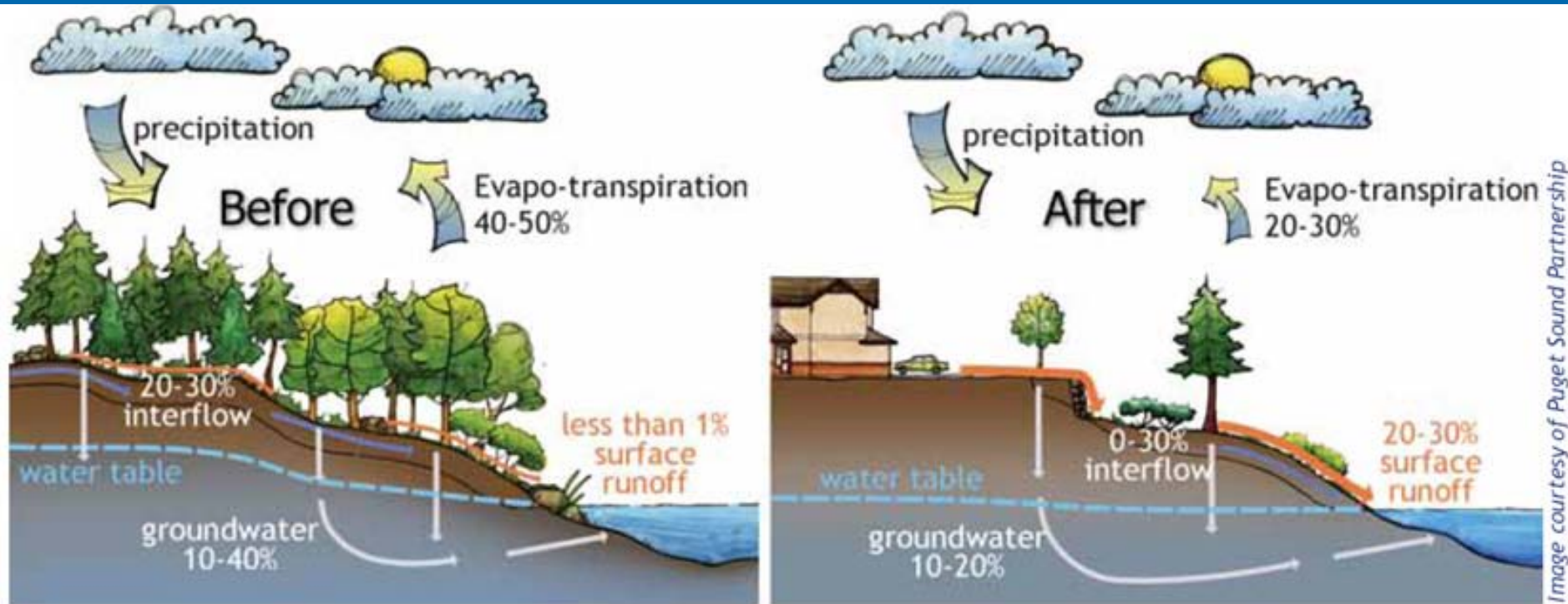


soil moisture groundwater

© 2008 Encyclopædia Britannica, Inc.

ocean covers 71 percent of Earth's surface
196,950,000 sq mi (510,000,000 sq km)

What we do



- For this area the numbers are more like this:
 - Rain = about 32", Predevelopment runoff about 6"
 - Post-development runoff about 15"
 - runoff is > and interflow/recharge is <

PROBLEMS WITH URBAN RUNOFF

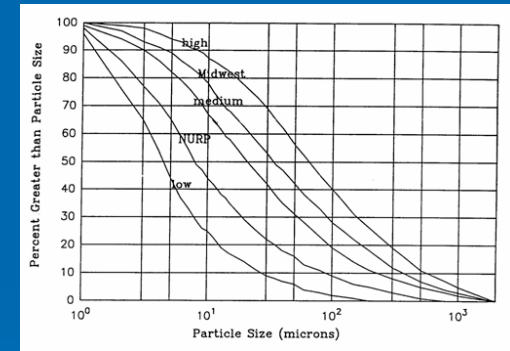


FLOODING



GROSS POLLUTANTS

REGULATORY POLLUTANTS



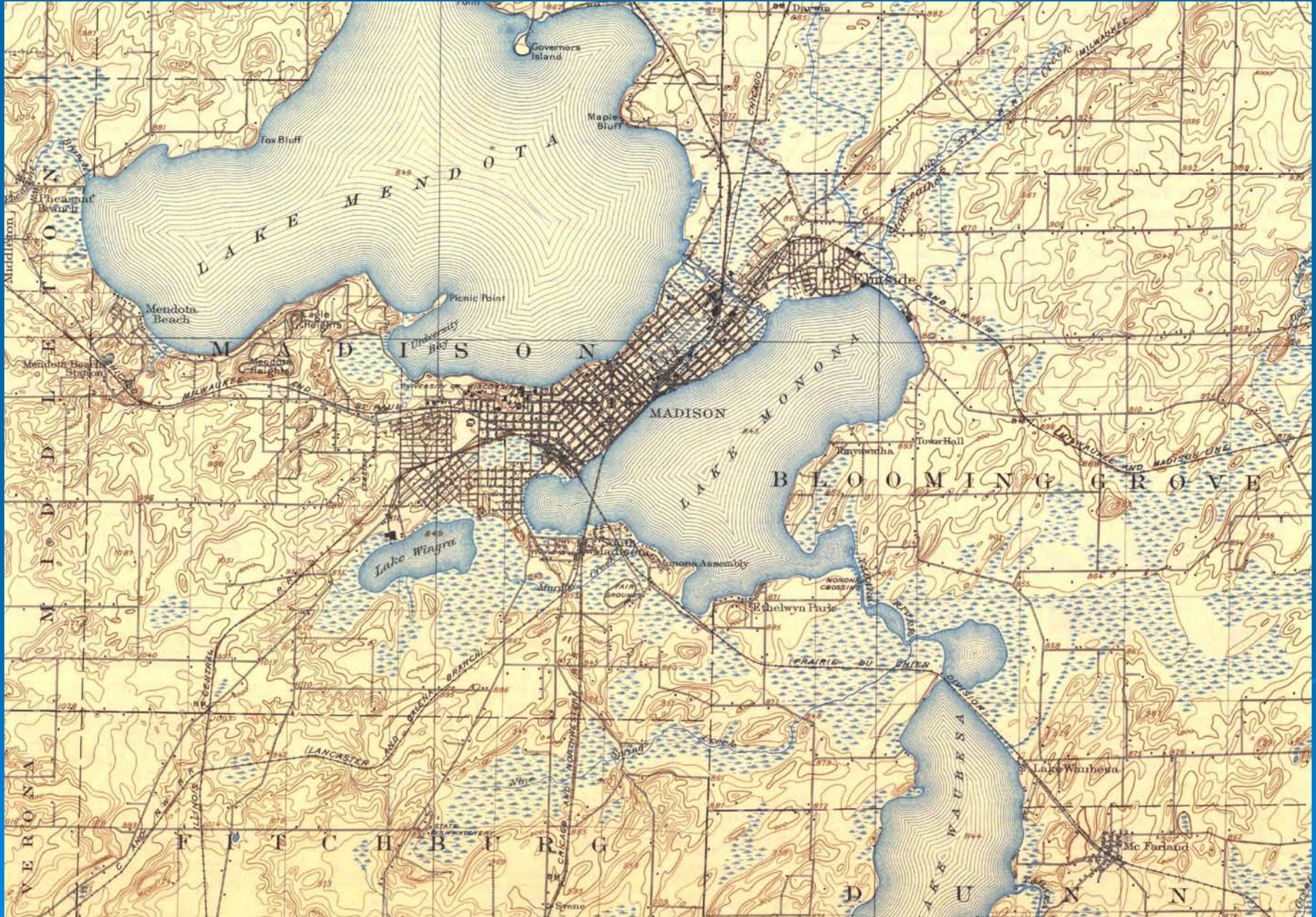
MAINTENANCE



Flooding in existing developed areas



FLOODING



FLOODING

Madison (or a good portion of it) is made land.

This causes:

- Surface water flooding problems
- Basement groundwater problems
- Infiltration to sanitary sewer mains/laterals
- Challenges meeting storm water treatment goals



FLOODING – In New Areas

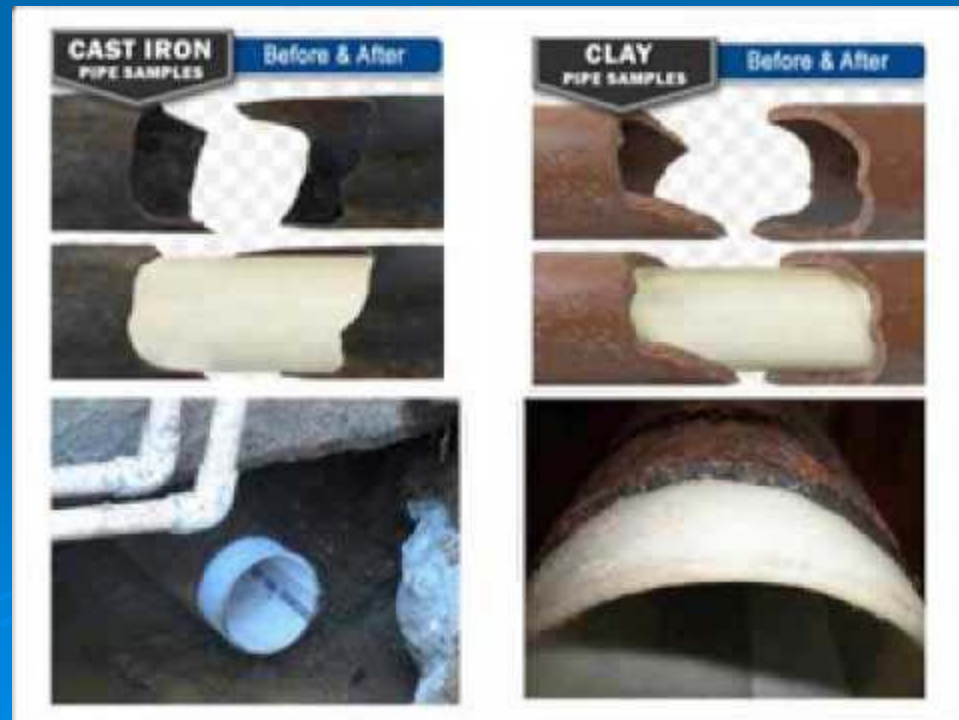
➤ Greg's rules of thumb:

- Everyone cares about water quality and infiltration until the water goes where they don't want it (flooded streets, basements, window wells, sanitary sewers, flat roofs that don't drain....) then they want it gone.
- Water quality and flood control are not mutually exclusive goals but it is pretty close

FLOODING – Sanitary

WHAT ARE WE DOING ABOUT FLOODING?

We began a significant sanitary sewer pipe lining program about 10 years ago to reduce infiltration:



FLOODING – Ground Water

WHAT ARE WE DOING ABOUT FLOODING?

When the lake levels (especially Monona) rise above the regulatory maximums this becomes a significant problem.

This is probably the most challenging public works problem as it is not one that is easily resolved using traditional public works projects, and falls to property owners to resolve.

FLOODING – Stormwater Treatment

WHAT ARE WE DOING ABOUT FLOODING?

Stormwater treatment is essentially impossible in areas where the pipe is partially submerged. This is true for:

- catchbasins/ponds
- screen or filter technologies
- infiltration devices (pavement, gardens)

*** green roofs - are possible**

Gross Pollutants

Generally speaking this is what most people think of when they refer to water pollution.

They are not however regulated by EPA/WDNR



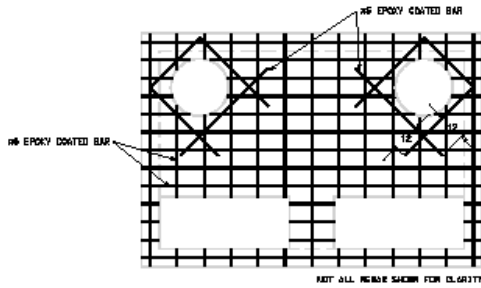
Gross Pollutants



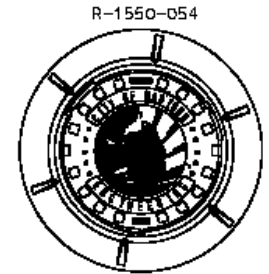
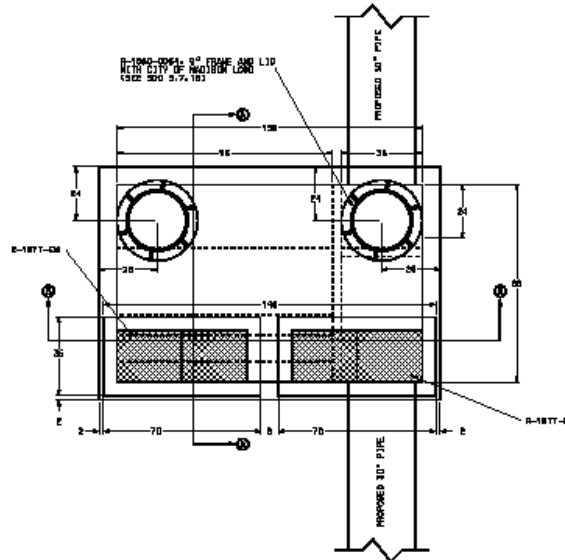
Gross Pollutants

VLAS AVENUE BIKE PATH PROJECT NO. 53W0532	SHEET NO. D-3
DETAIL	
TREATMENT STRUCTURE CITY OF MADISON	

ROOF REINFORCEMENT



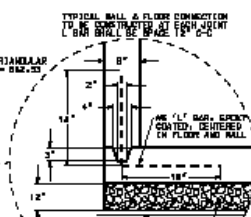
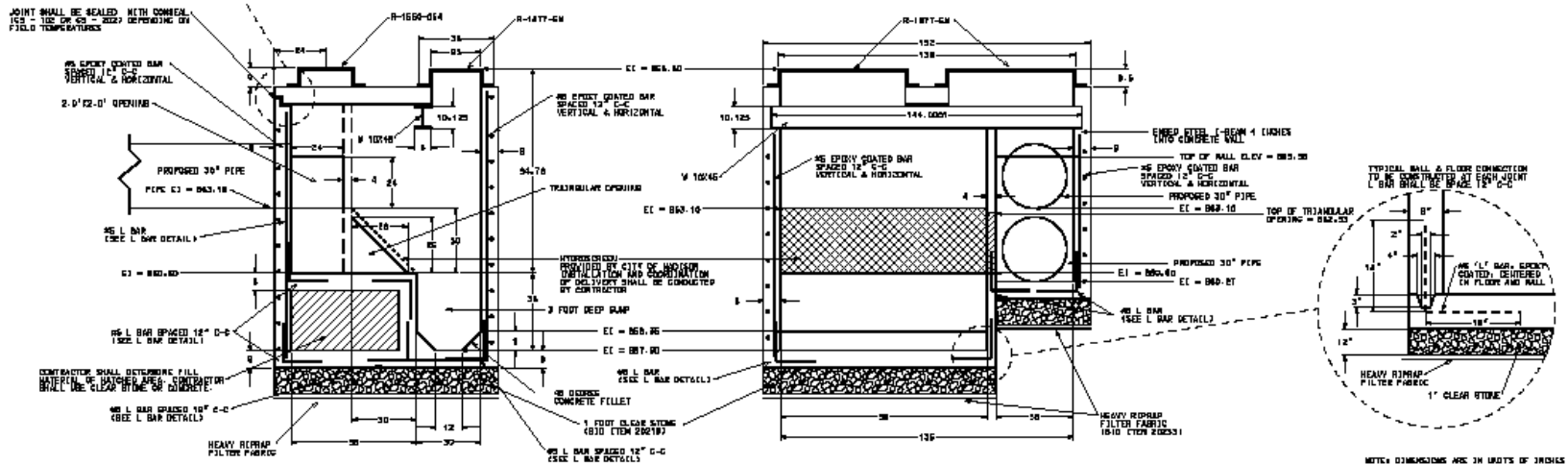
- ROOF REINFORCEMENT NOTES:**
1. EPOXY COATED REINERS SHALL BE USED ON ALL CASES
 2. #6 REINERS PLACED ON 8" CENTERS
 3. 3" CLEAR SHALL BE MAINTAINED
 4. ROOF THICKNESS SHALL BE 8" MINIMUM



SECTION A-A

SECTION B-B

JOINT SHALL BE SEALED WITH CONCRETE (50 - 100 SW 20 - 200) DEPENDING ON FIELD TEMPERATURES



NOTICE: DIMENSIONS ARE IN UNITS OF FEET AND INCHES

PLOT SCALE: _____ PLOT NAME: _____ REV. DATE: _____

Gross Pollutants



Gross Pollutants



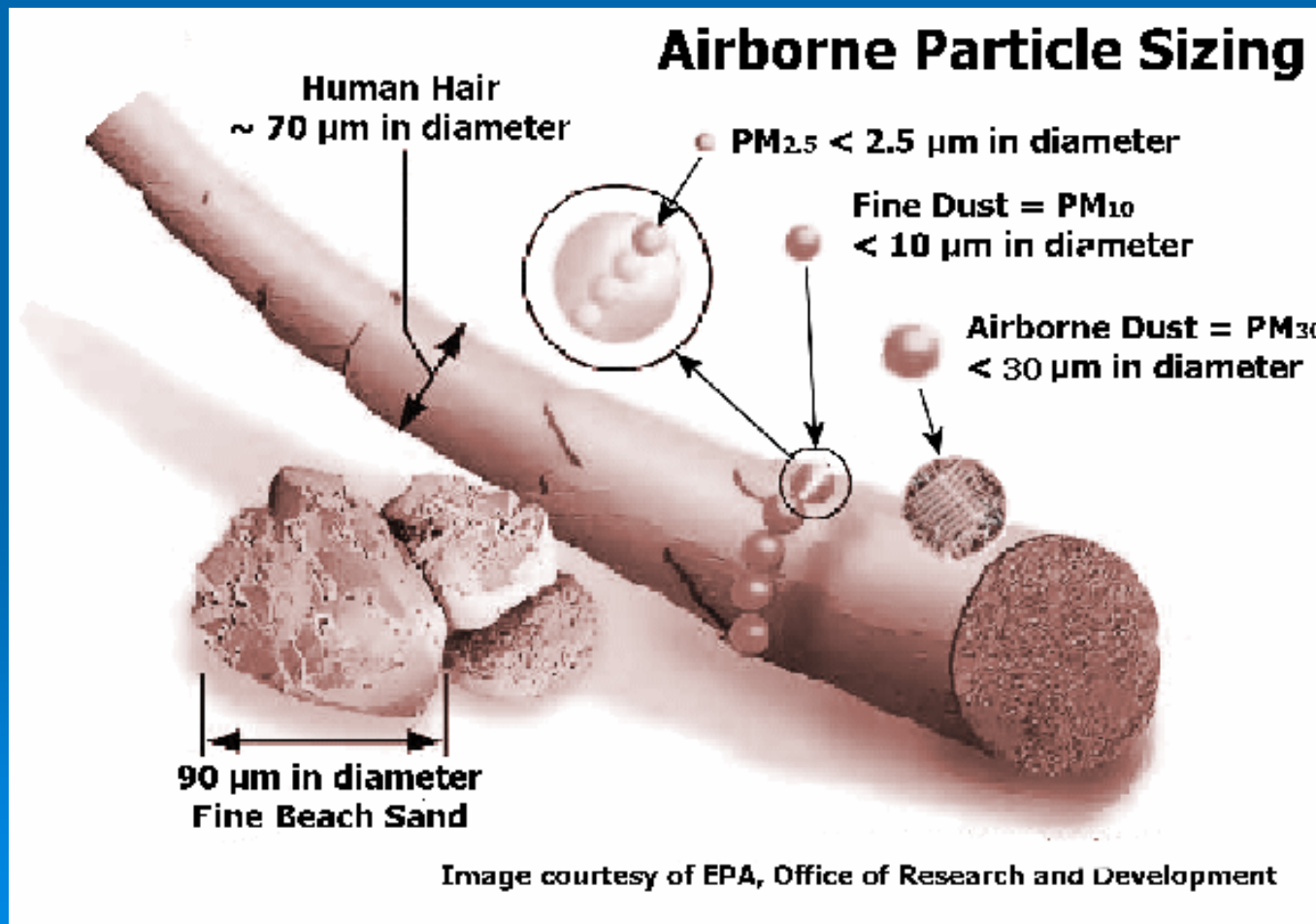
All regulations for urban pollutants
control primarily:

**Total Suspended Solids
(TSS)**



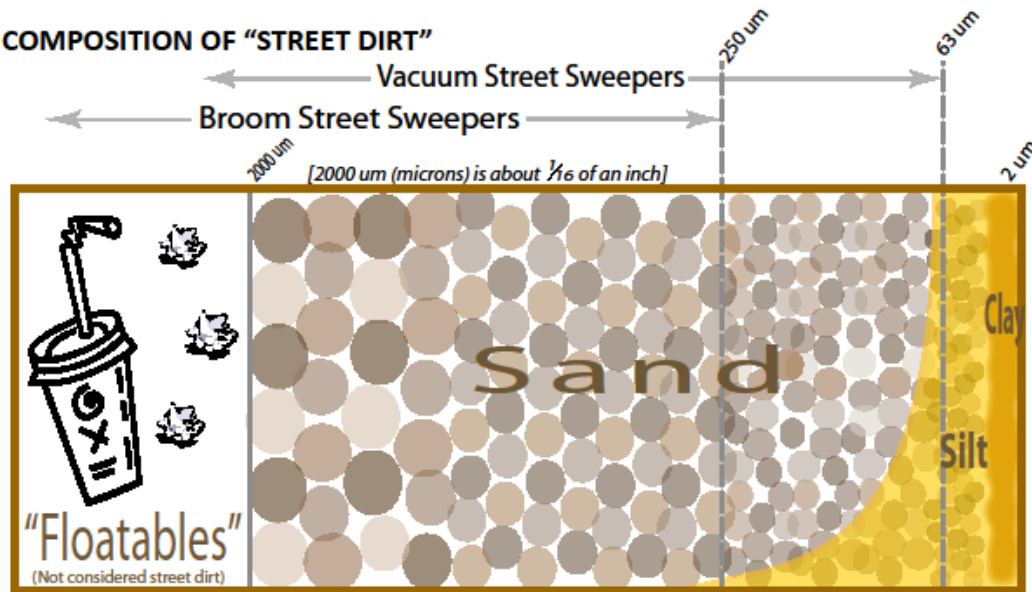
What exactly is TSS?

The **micrometre** (International spelling as used by the International Bureau of Weights and Measures; SI symbol: μm) or **micrometer** (American spelling) is an SI derived unit of length equaling 1×10^{-6} of a metre (SI standard prefix "micro-" = 10^{-6}); that is, one millionth of a metre (or one thousandth of a millimetre, 0.001 mm, or about 0.000039 inch). The symbol μm is sometimes rendered as **um** if the symbol μ cannot be used, or if the writer is not aware of the distinction.

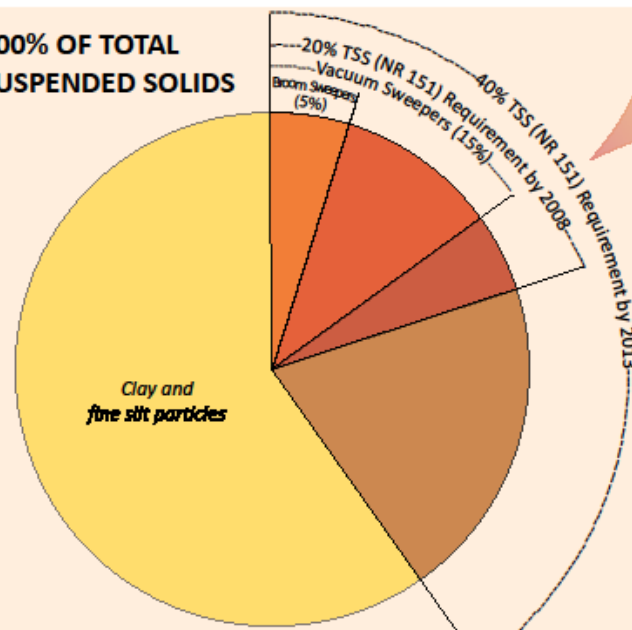


Street Sweeping and DNR Regulations

COMPOSITION OF "STREET DIRT"



100% OF TOTAL SUSPENDED SOLIDS



The values for sweeping are under perfect conditions; actual collection is less.

TOTAL SUSPENDED SOLIDS

The Story...

About 95% of dirt on the street is SAND. Broom Sweepers can pick up about 65% of street dirt; Vacuum Sweepers can get up to 95%.

However... DNR Regulations state that we have to control **Total Suspended Solids (TSS)**. Sand makes up a very small portion of TSS; silt and clay (much smaller particles) make up most of TSS.

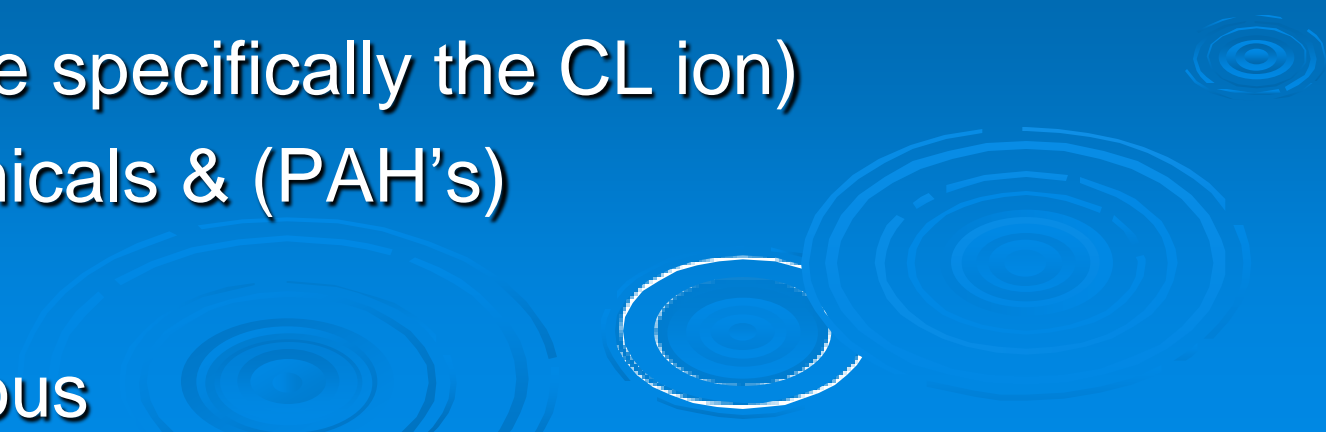
Sweepers aren't able to pick up much of the smaller particles (Broom Sweepers get about 5%; Vacuum Sweepers up to 15%).

Other practices like Detention Ponds can control up to 80% TSS, but they are generally only located in areas developed after 1980. State Regulations indicate that CITYWIDE we have to control **20% TSS by 2008** and **40% by 2013**.

TSS is regulated.

What is in it?

Urban storm water runoff contains a great number of contaminants. Primary ones are mostly associated with our automobiles (1-5):

- 1) Zinc
 - 2) Cadmium
 - 3) Copper
 - 4) Salts (more specifically the CL ion)
 - 5) Petrochemicals & (PAH's)
 - 6) Bacteria
 - 7) Phosphorous
- 

How do we meet these regulations??

We have meet the 40% TSS reduction associated with NR-151 already using traditional methods:

- 1) ponds
- 2) catchbasins/screens
- 3) sweeping
- 4) infiltration/raingardens
- 5) adaptive management (* farm practices)

How do we meet these regulations??

Meeting the requirements of NR-151 is the beginning of the reductions required by the TMDL. As measured from a baseline of 0% the TMDL requires a 82% TSS control for the entire regulated part of the City of Madison.

- 1) ponds can remove 80%
- 2) catchbasins/screens can remove 15%
- 3) sweeping can remove 5-12%
- 4) infiltration/raingardens can remove 100%

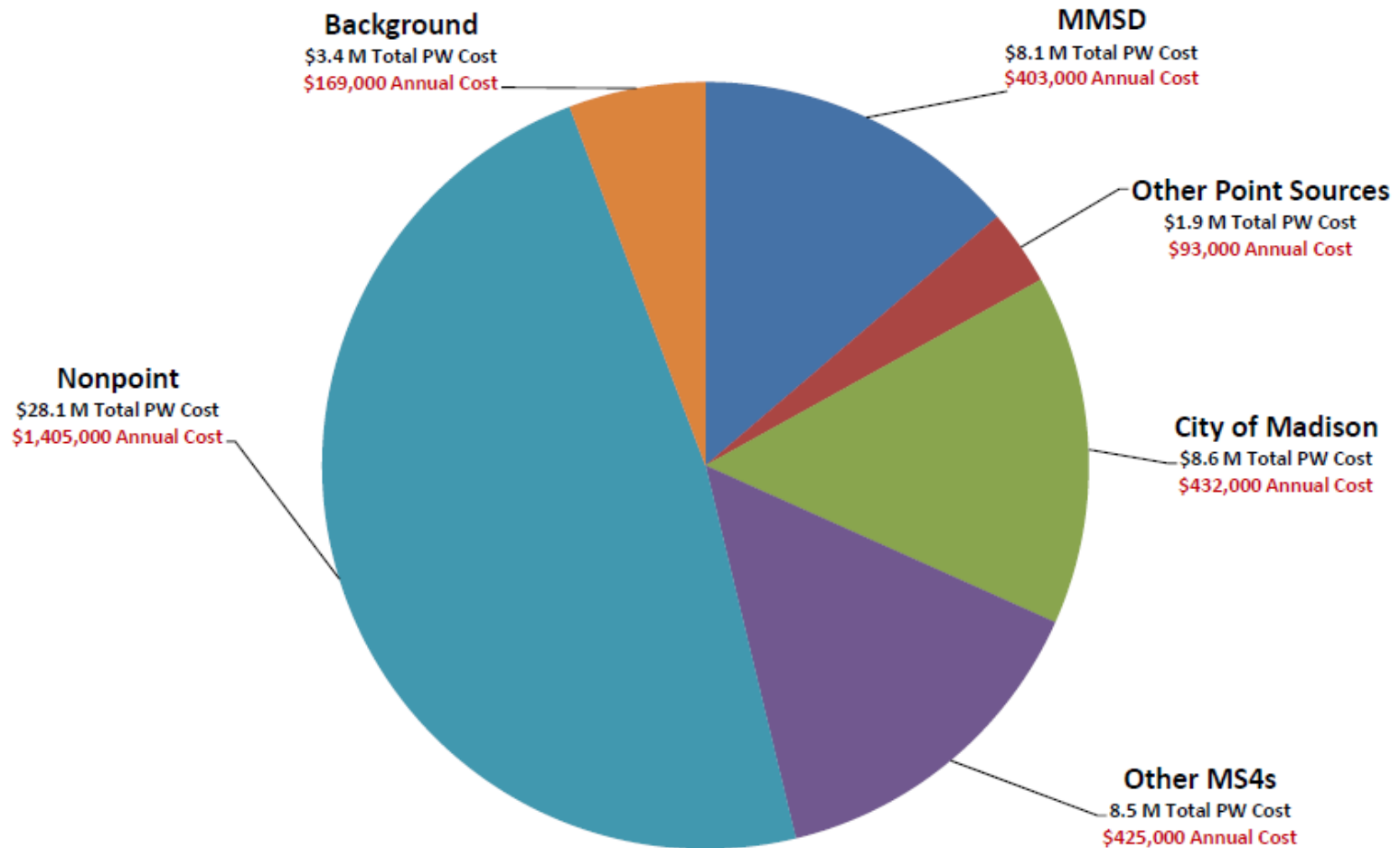
HOW: Traditional Compliance Approaches

- **Independent actions**
- **Discharge focused solutions**
- **Expensive**



What is the Potential Price Tag For Adaptive Management?

Yahara Watershed Adaptive Management Cost Estimates (Point Sources at Current Phosphorus Loads)



Other Programs



Terrace Rain Gardens

- City Engineering administers a program that looks at every reconstruction and resurfacing project in the coming year to identify projects that can have terrace rain gardens installed.
- They become the responsibility of the property owner
- Average costs including planting is about 2000
- The property owner is required to pay a maximum of 400 or $\frac{1}{4}$ of the cost whichever is less.



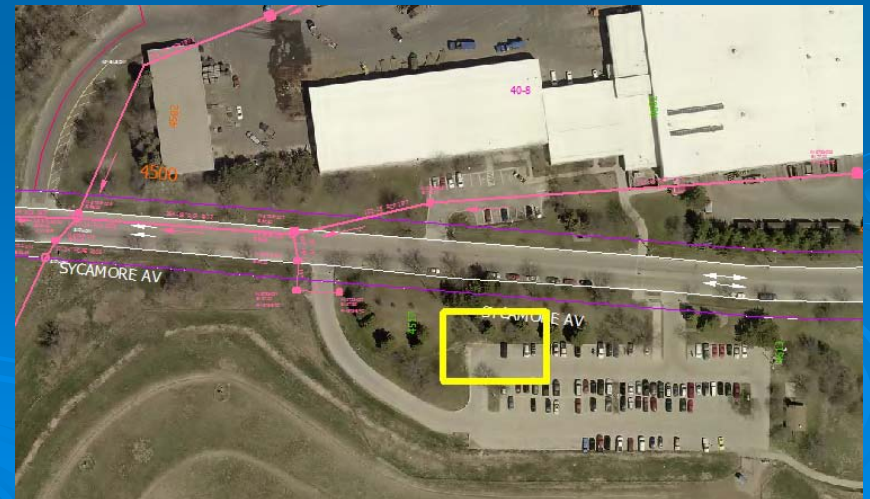
Rain Gardens on Public Lands

- City Engineering works other city agencies to construct at least one public rain garden every year on lands owned by the City of Madison.
- Often these are constructed by our operations crews.



Pervious Pavement

- City Engineering has constructed on pervious pavement pilot and will be constructing approximately 500 feet of pervious sidewalk as part of “CENTRAL PARK in 14”
- We are providing the test site for a pervious pavement test site being monitored by the USGS and the WDNR.
- Precast pervious sidewalk (100’ trial in 2016)
- Pervious pavement (two areas are being tested in 2017 with Gregory Street).



Maintenance Operations



➤ **Maintenance operations include primarily:**

- **Leaf collection**
- **Street Sweeping**
- **Catchbasin cleaning**



Changes ?

Leaf collection.

We no leaves are bad for water quality,
but how bad?



Pilot Study – Leaf Collection Management



- Leaf collection identified by Yahara CLEAN as reasonable measure to reduce Total P delivered to Madison lakes
- Model simulations estimate 23% of annual P load occurs in fall
- What % reduction (credit) can Madison and other MS4s in Rock River basin expect by collecting leaves?

Measurement of Phosphorus in Water and Leaves



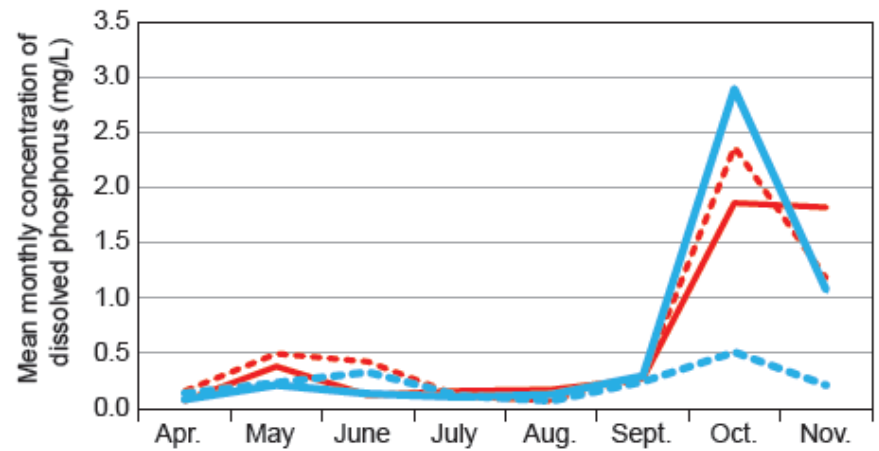
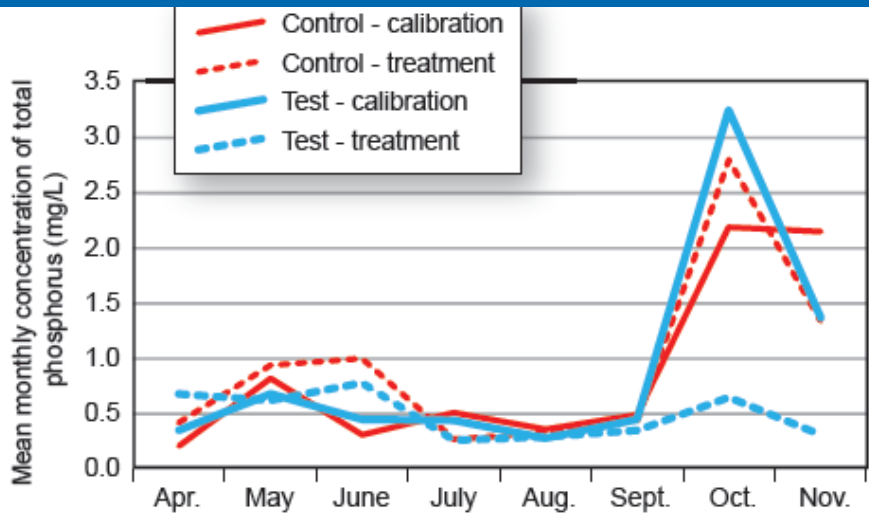
Photos by USGS

Visual Evidence of Phosphorus in Water



Results

- In Madison 56% of the total annual discharge of TP to the lakes occurs in about 1 month.
- With active collection and removal efforts (not what people or the city normally do) we can reduce this by about 80%
- Study has 1 year left – and has some troubling implications on what we do and how we do it.



Questions and Discussion

