

Quantifying Gross Solids and Phosphorous Loads Captured by Catch Basins and Manholes



Melissa Baker, Water Resource Technician
Capitol Region Watershed District, St. Paul, MN

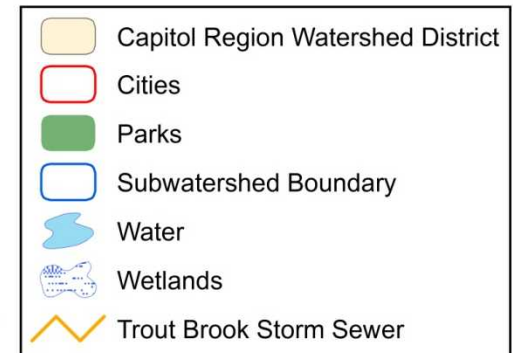
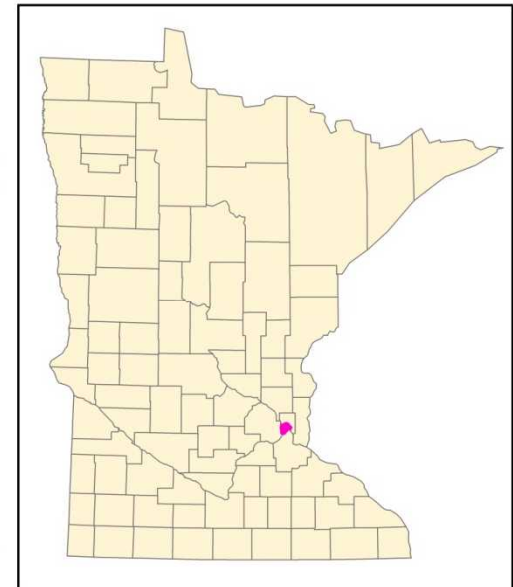
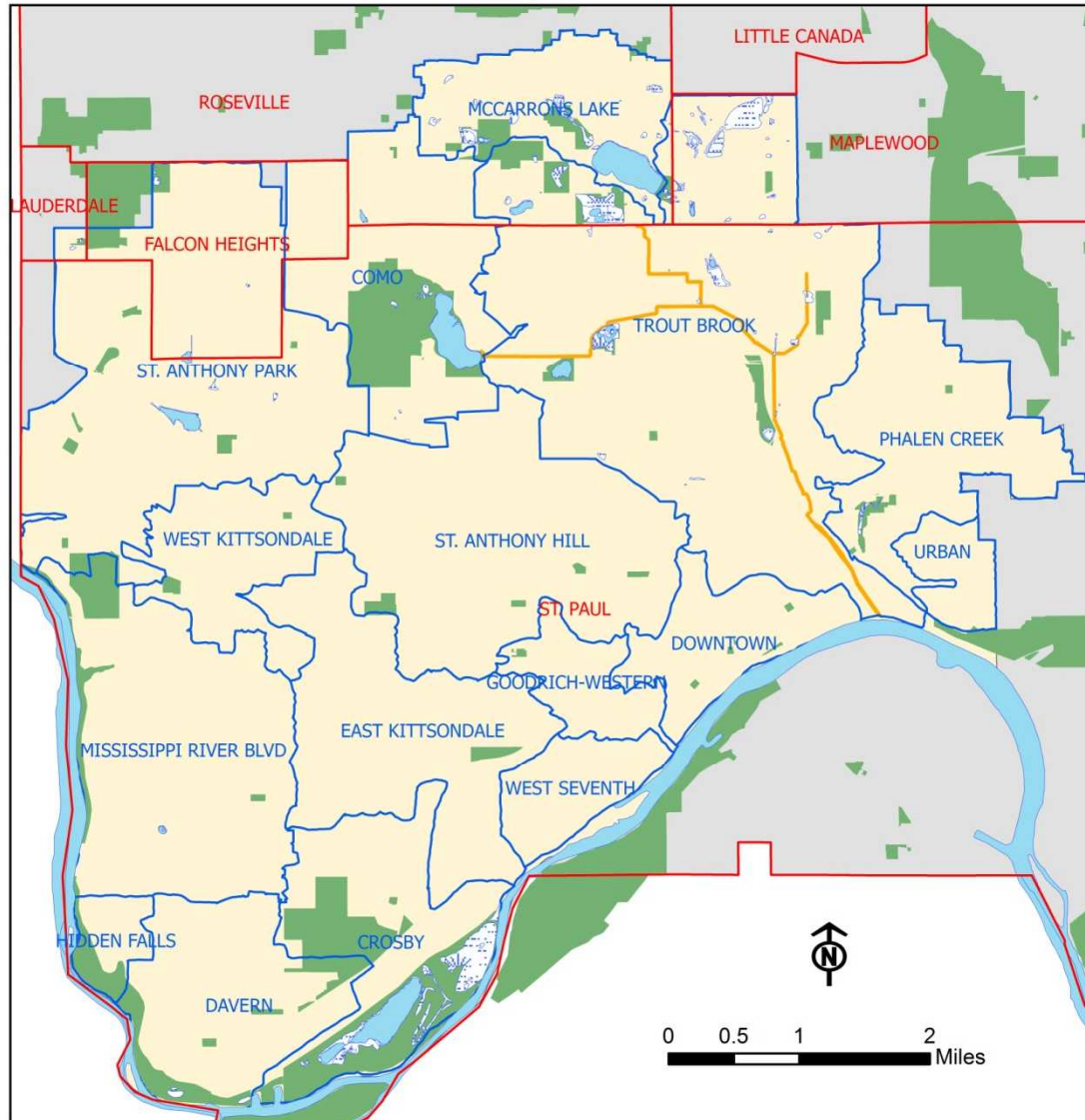
Watershed Districts

Special Purpose Unit of Local Government

- MN Watershed law established in 1955
- Purpose: **Manage Water Resources**
- 48 throughout Minnesota
- Directed by a Board of Managers
- Funded through tax levy
- Regulatory authority

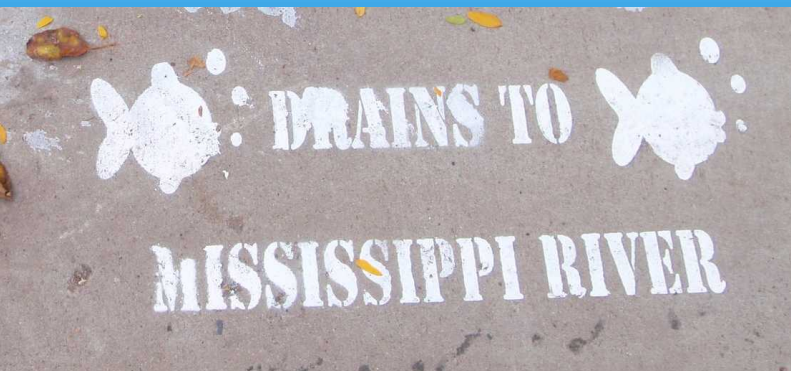


Capitol Region Watershed District



Capitol Region Watershed District

- Population: 226,000
- 42% coverage by impervious surfaces
- Few natural streams
- All runoff drains to the Mississippi River



Arlington Pascal Project

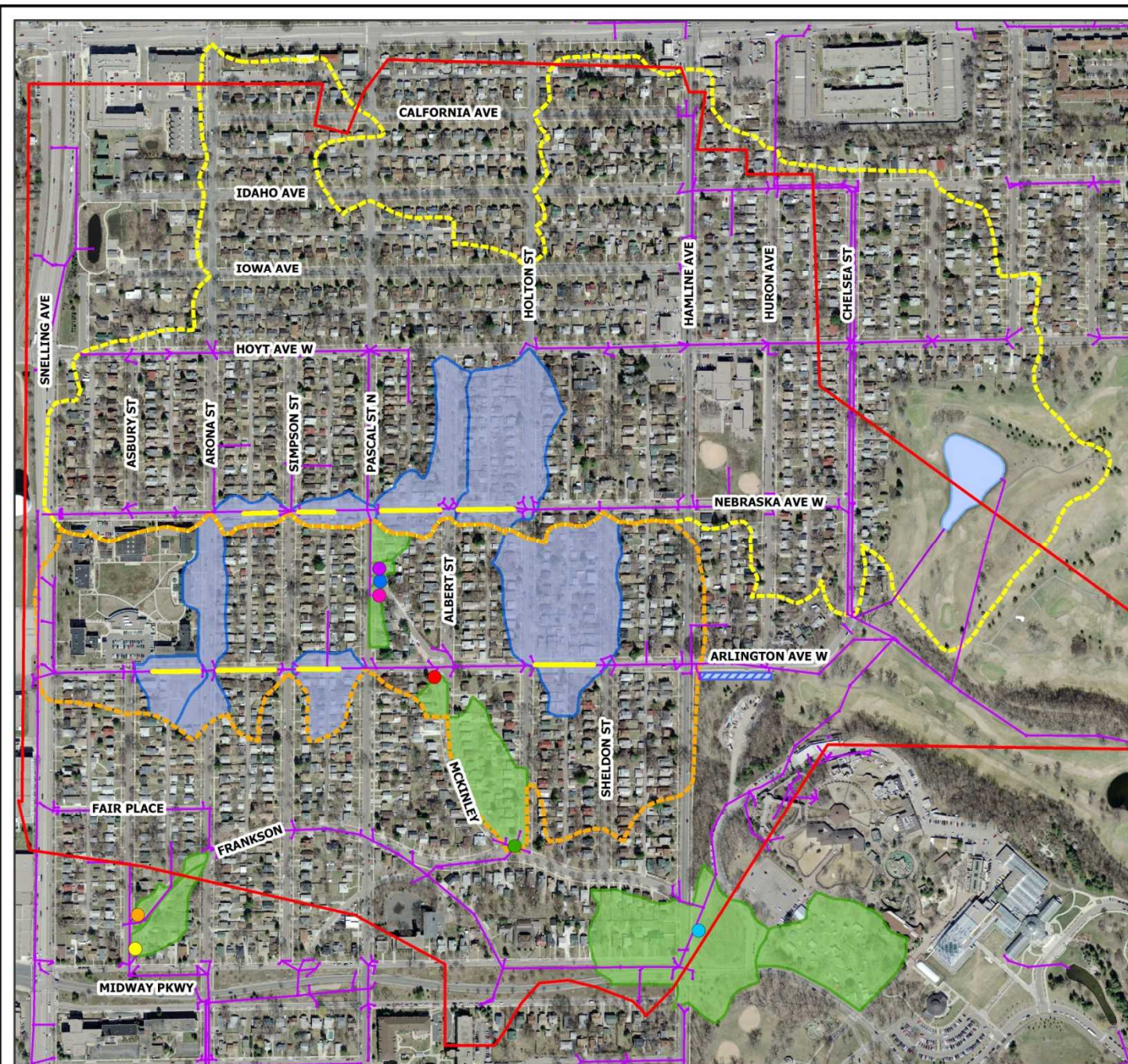
\$2.7 million project

- Reduce localized flooding
- Improve water quality of Como Lake

Construction of 18 stormwater BMPs

- Underground stormwater storage and infiltration system
- Regional stormwater pond
- 8 infiltration trenches
- 8 raingardens





Legend

- Como 7 Subwatershed Boundary
- Storm Sewer

Stormwater BMP

- Arlington-Hamline Facility
- Como Park Regional Pond
- Infiltration Trench

Rain Garden

- Arlington - McKinley
- Asbury North
- Asbury South
- Frankson - McKinley
- Hamline Midway
- Pascal Center
- Pascal North
- Pascal South

Drainage Area

- Arlington-Hamline Facility
- Como Park Regional Pond
- Rain Garden
- Infiltration Trench



Infiltration Trenches

- 8 constructed under city streets
- Stormwater rate & volume control
- Water quality benefits

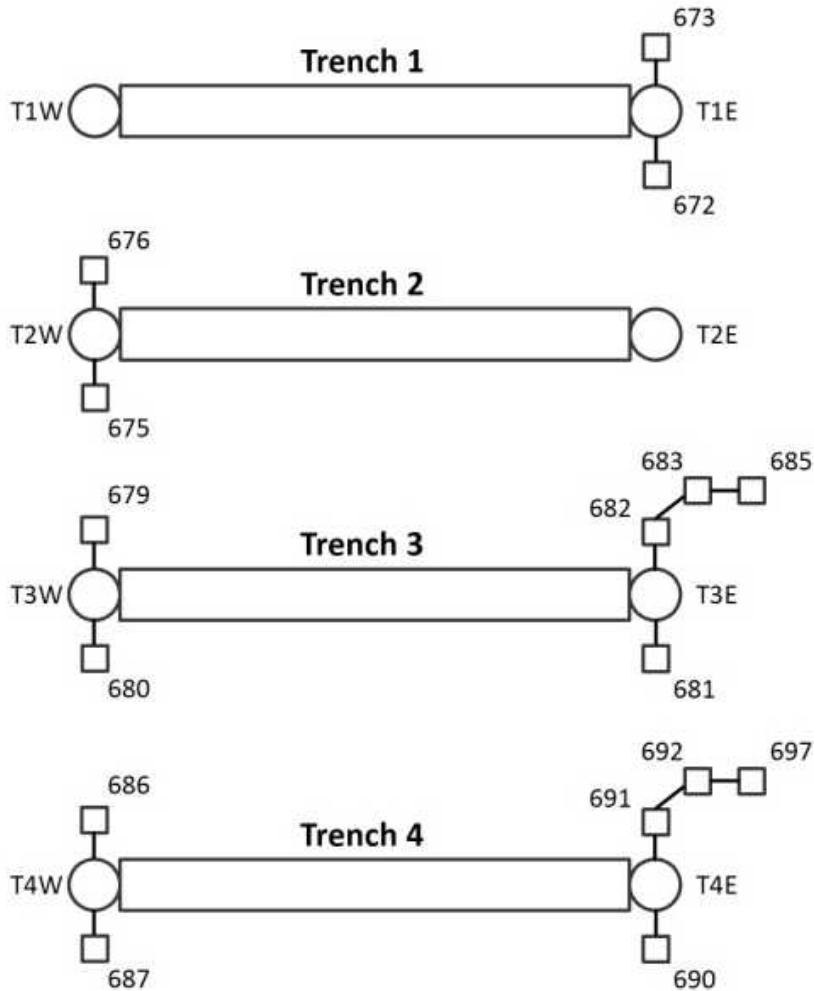


Catch Basins and Manholes

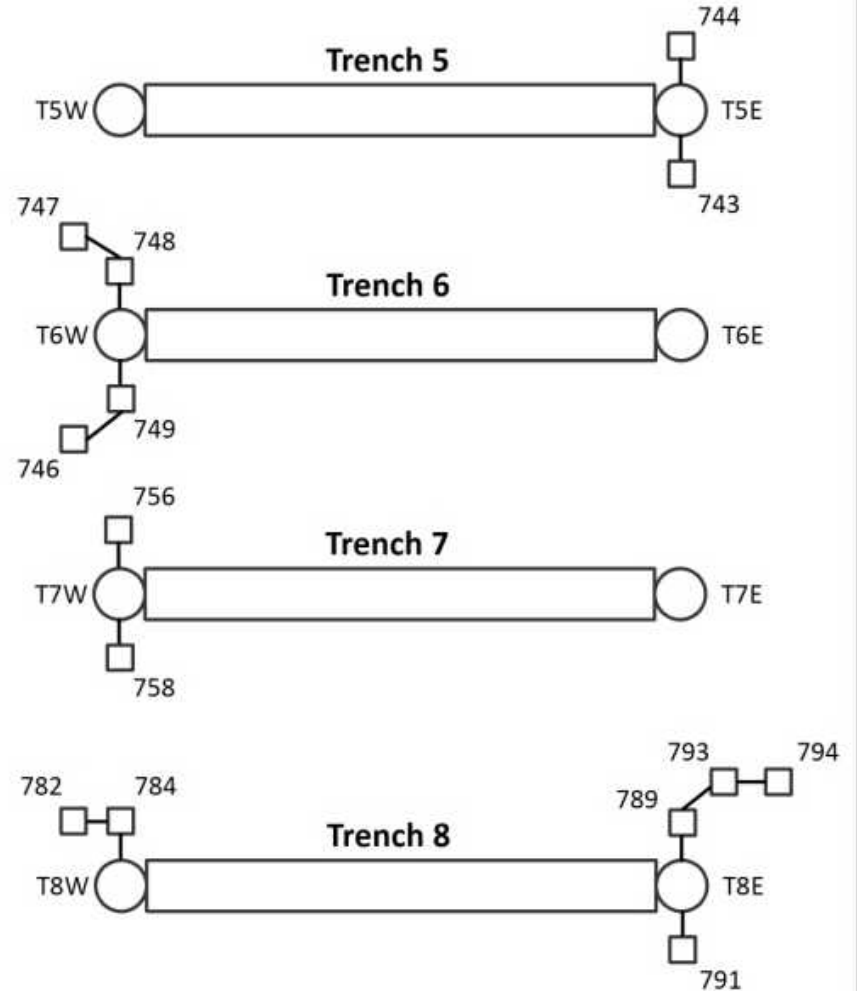
- 30 sumped catch basins
- 16 sumped manholes
- Regularly inspected and maintained



Trench Schematic



Nebraska Avenue Trenches



Arlington Avenue Trenches

○ Sumped Manhole □ Sumped Catch Basin

Not To Scale

Gross Solids

- Routine Inspections: considerable volume of pollutants (gross solids) captured by the catch basins and manholes
- Litter, organic debris, and coarse sediments ($>75\mu\text{m}$) transported in urban stormwater runoff.



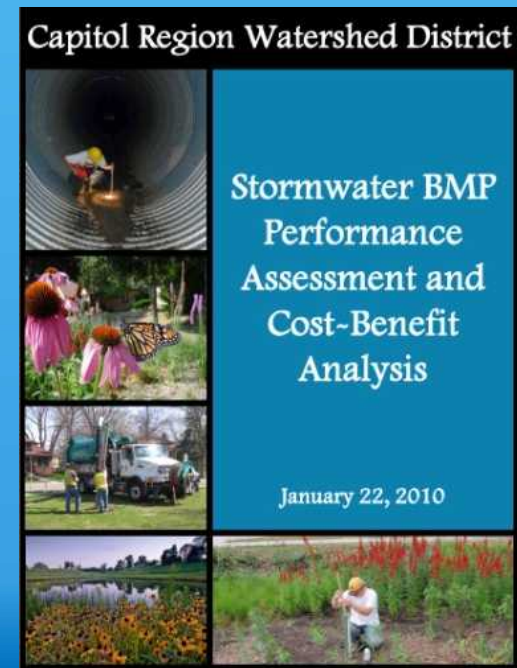
BMP Performance Analysis

Comprehensive analysis of Arlington Pascal Project and individual BMPs

- Monitoring & modeled data (BMP performance)
- Actual construction costs
- Actual BMP O & M costs

Collectively, data (performance, cost) was used to conduct a cost-benefit analysis.

*First published in 2010. Updated in 2012.



Gross Solids Study

- June 2011
- Sample collection from all 30 catch basins
- Bulk density, TP, particle size
- Calculate annual pollutant loads for each unit
 - Gross solids
 - Total phosphorous
 - 2007 to present



Sample Collection



Bulk Density Results

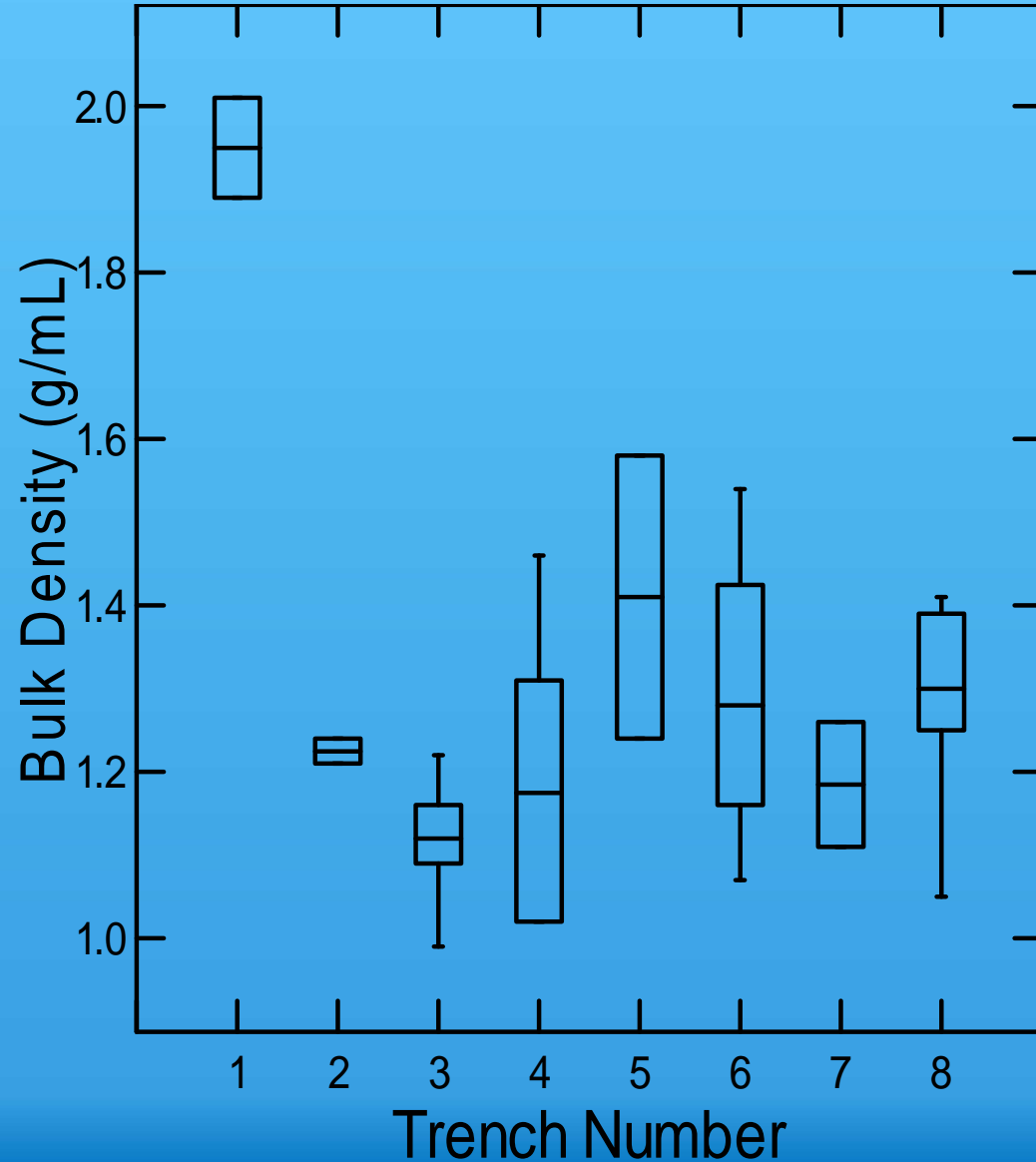
Range:

0.99-2.01 g/mL

Average:

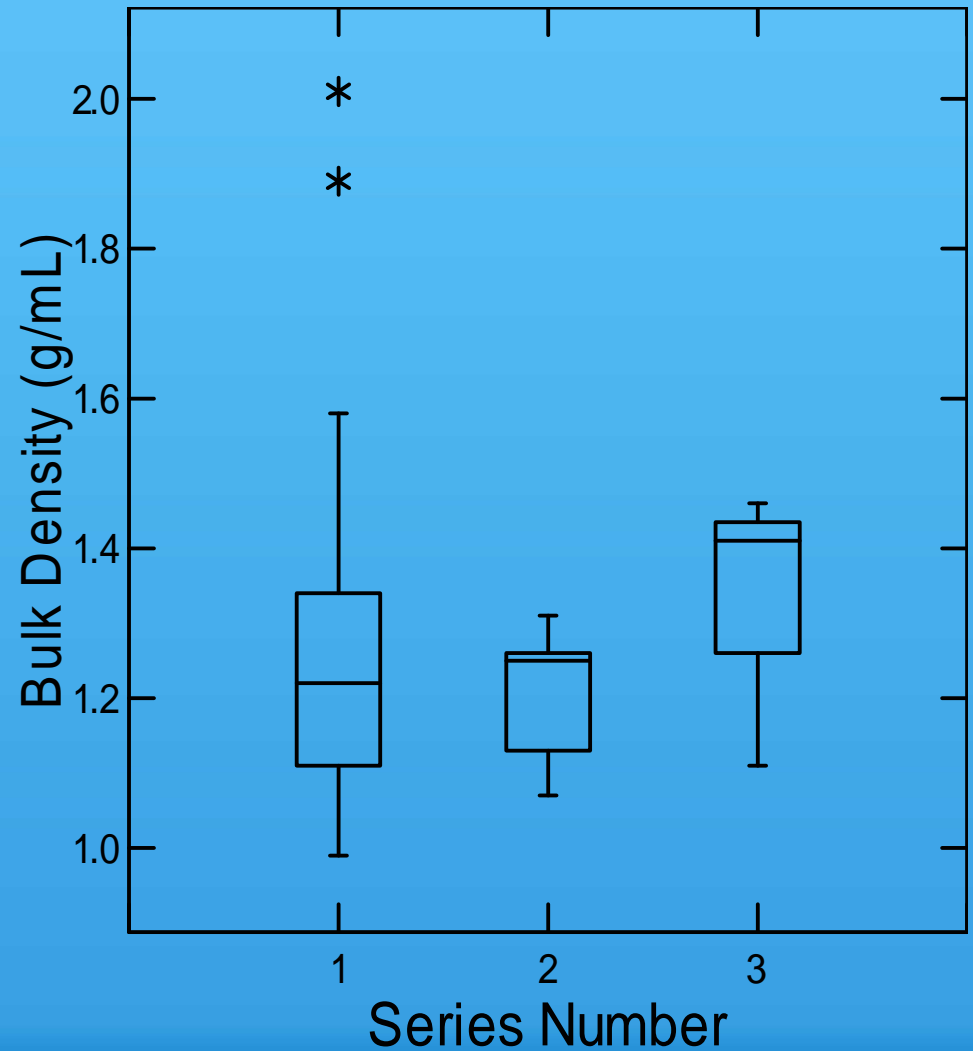
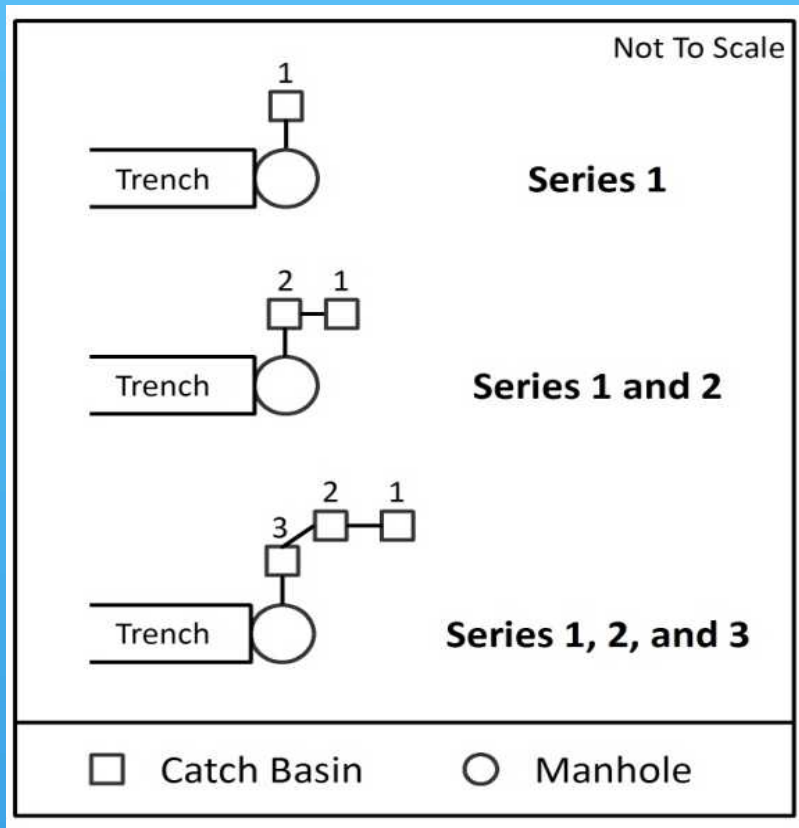
1.28 g/mL

(80 lbs/cf)



*Mass of soil per unit volume

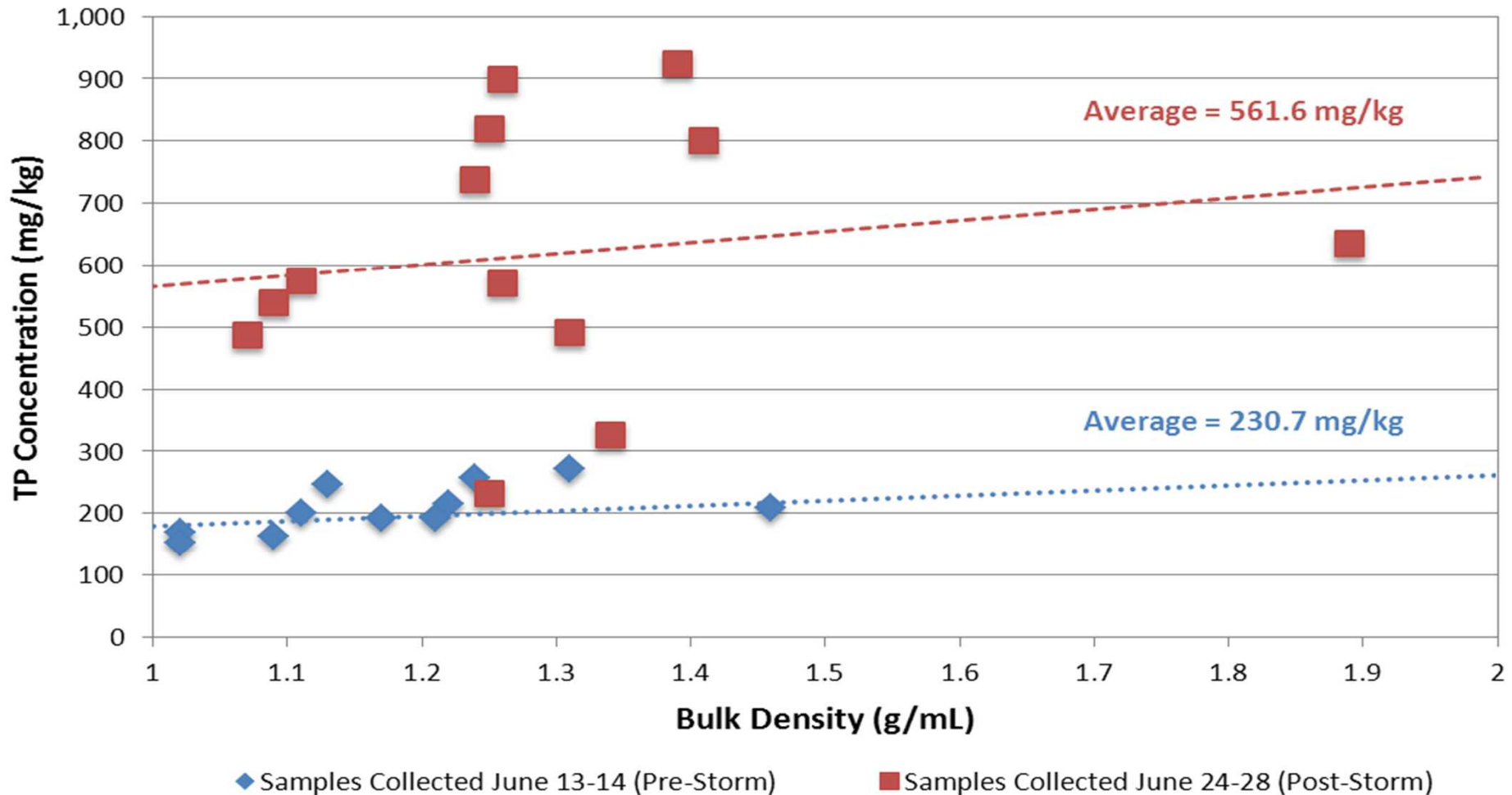
Bulk Density Results



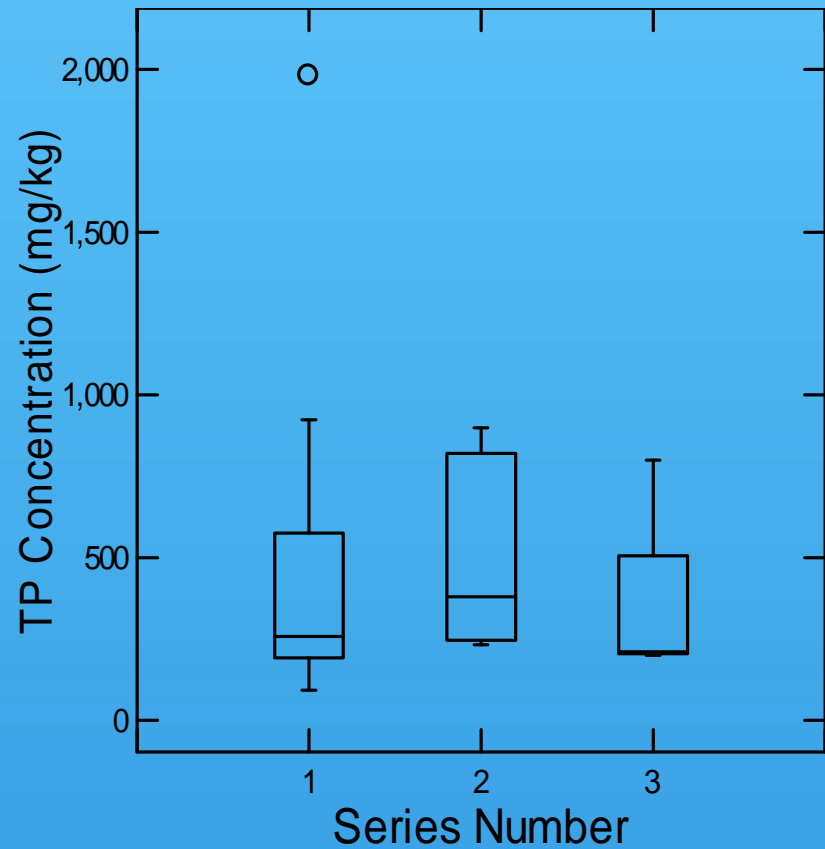
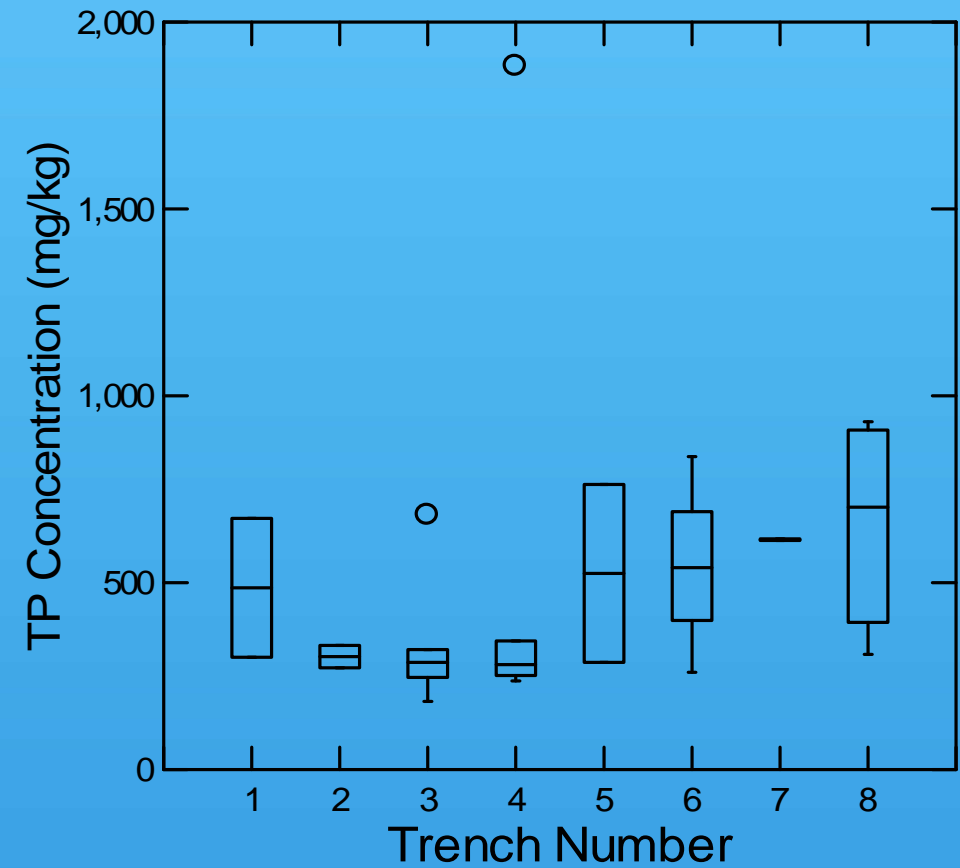
Total Phosphorous Results

Range: 92-1,980 mg/kg

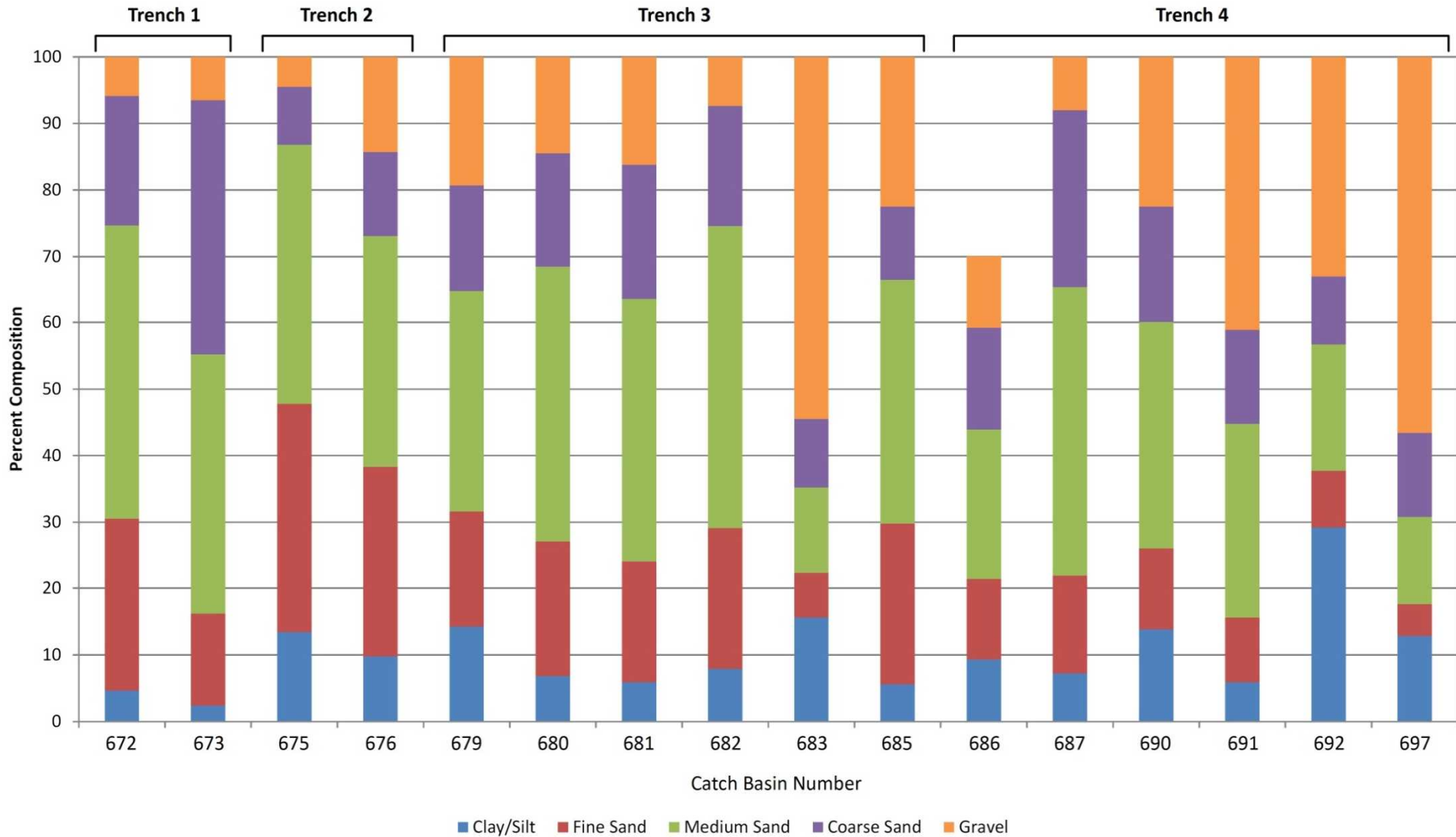
Average: 402 mg/kg*



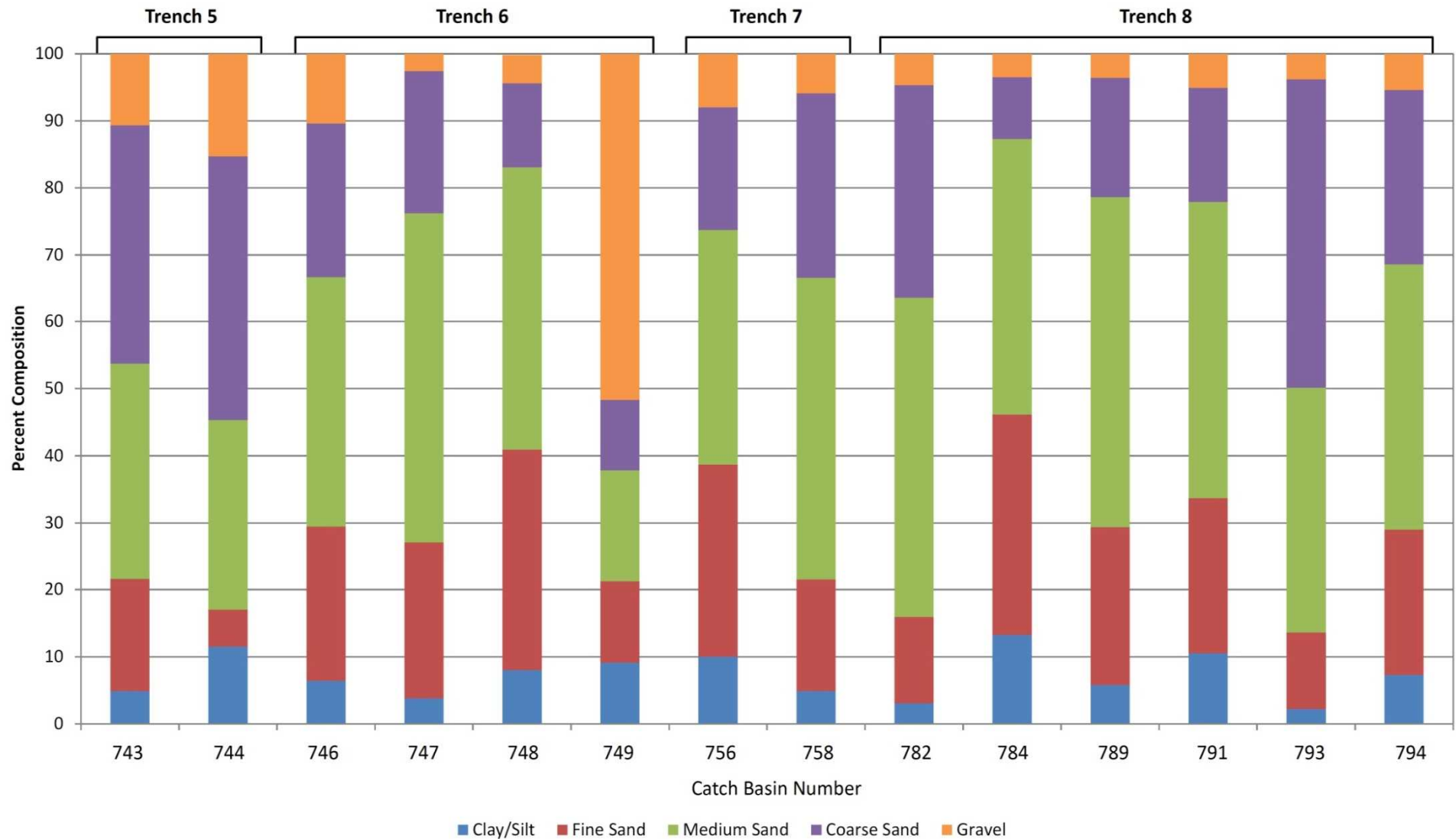
Total Phosphorous Results



Particle Size Analysis



Particle Size Analysis



Gross Solids Study Results

- Average bulk density and TP concentrations
- Gross solids depths (from inspection data back to 2007)
- Calculate volume of gross solids in each unit
 - Catch basin Volume = $L \times W \times H$
 - Manhole Volume = $\pi R^2 H$
- Calculate annual loads (gross solids, TP)
 - 2007-2010

Gross Solids Study Results

	Gross Solids (lbs)		TP (lbs)	
	CB	MH	CB	MH
2007	8,999	5,536	3.6	2.2
2008	16,513	9,568	6.6	3.8
2009	24,683	7,517	9.9	3.0
2010	16,513	2,935	6.6	1.2

On average, **23,000 lbs** of gross solids and **9 lbs** of TP were captured each year

Gross Solids Study Results

Catch Basins

- 560 lbs gross solids/year
- 0.22 lbs TP/year

Manholes

- 400 lbs gross solids/year
- 0.19 lbs TP/year



92,000 lbs gross solids, 37 lbs TP removed from 2007-2010

Reports available online at: www.capitolregionwd.org

Capitol Region Watershed District

**BMP Performance and Cost-
Benefit Analysis:
Arlington Pascal Project
2007-2010**

March 9, 2012



Capitol Region Watershed District



**Arlington Pascal Project:
Gross Solids Accumulation Study**

March 9, 2012

Conclusions

- Regular maintenance, capture large loads
- Load accumulations independent of annual precipitation
- Other variables (subwatershed characteristics/climate) more influential
- More monitoring necessary
 - Better quantify loads in manholes
 - Year-to-year/seasonal trends

Questions?



Melissa M. Baker
melissa@capitolregionwd.org
651-644-8888