Is Stormwater Bioretention Catching your Attention?

Christine Pomeroy, Ph.D., P.E.
Assistant Professor

Department of
CIVIL & ENVIRONMENTAL ENGINEERING
THE UNIVERSITY OF UTAH

Why care about Stormwater?

Stormwater Problems

Urbanization changes the physical hydrology of a region

- Increasing impervious areas increases runoff volume and intensity
- Increasing impervious areas decreases infiltration
- Increased stormwater runoff increases stream erosion

Red Butte Creek in Research Park

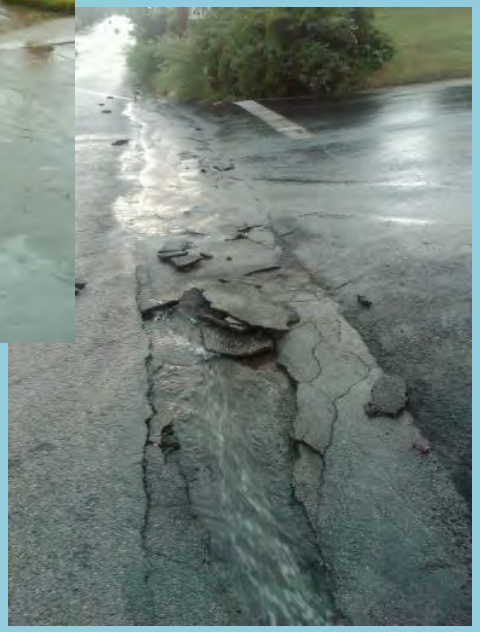
Why care about Stormwater?

Stormwater Problems

Urbanization changes the physical hydrology of a region

- Increased runoff causes flooding and damage

3300 S, 3300 E on June 19, 2011



4500 S, 2990 E on July 26, 2011

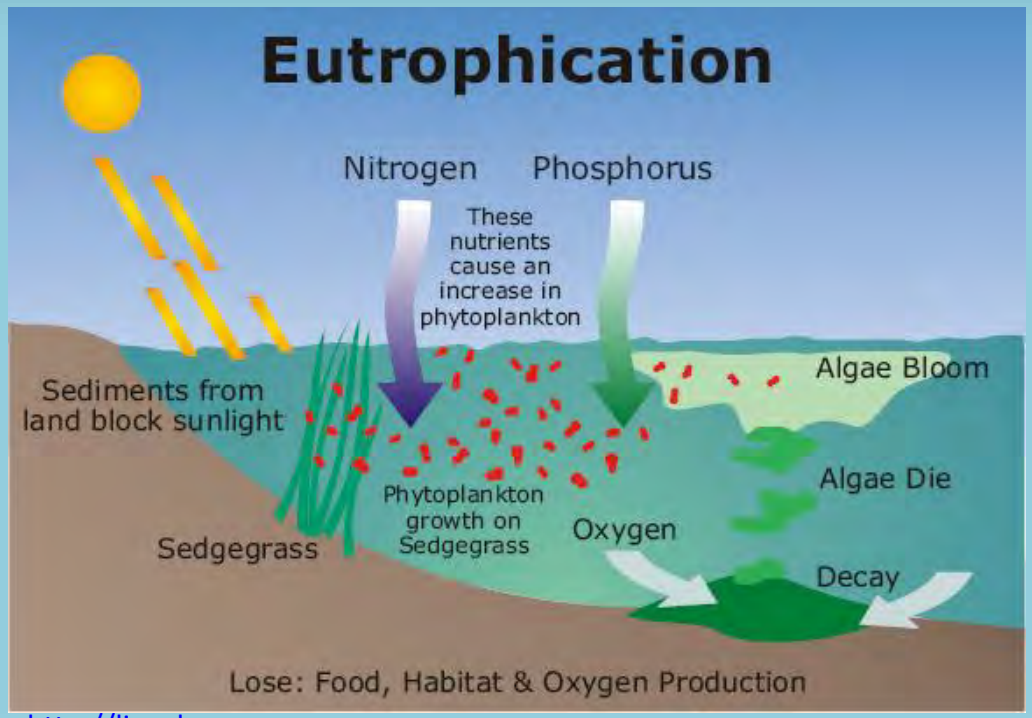
Is Stormwater Bioretention Catching your Attention?

Why care about Stormwater?

Stormwater Problems

Urbanization pollutes surface waters

- Nutrients carried by stormwater causes eutrophicaiton
- Stormwater runoff transports and concentrates pollution

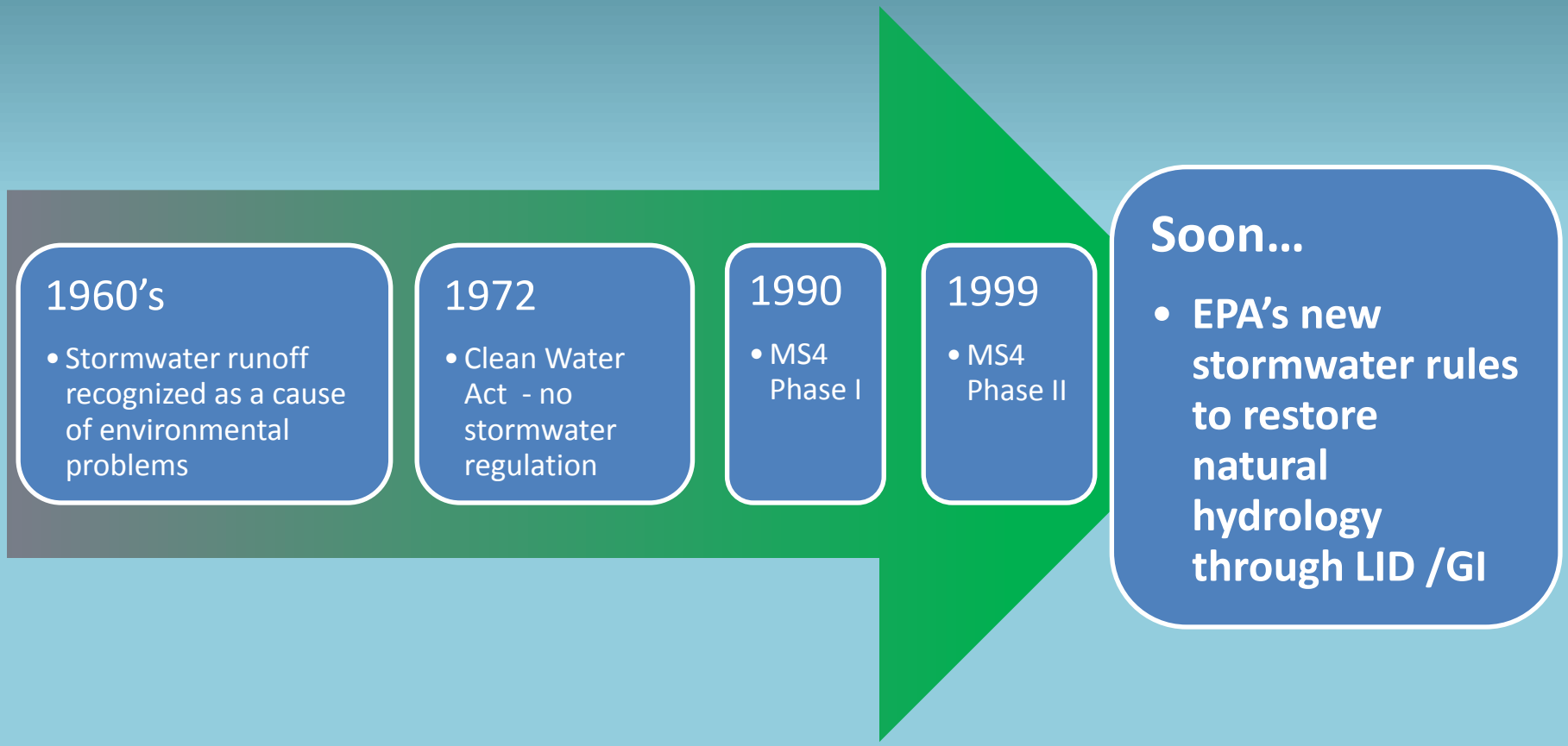


http://lincoln.ne.gov

Wurtsbaugh, 2008

Why care about Stormwater?

Stormwater Policy



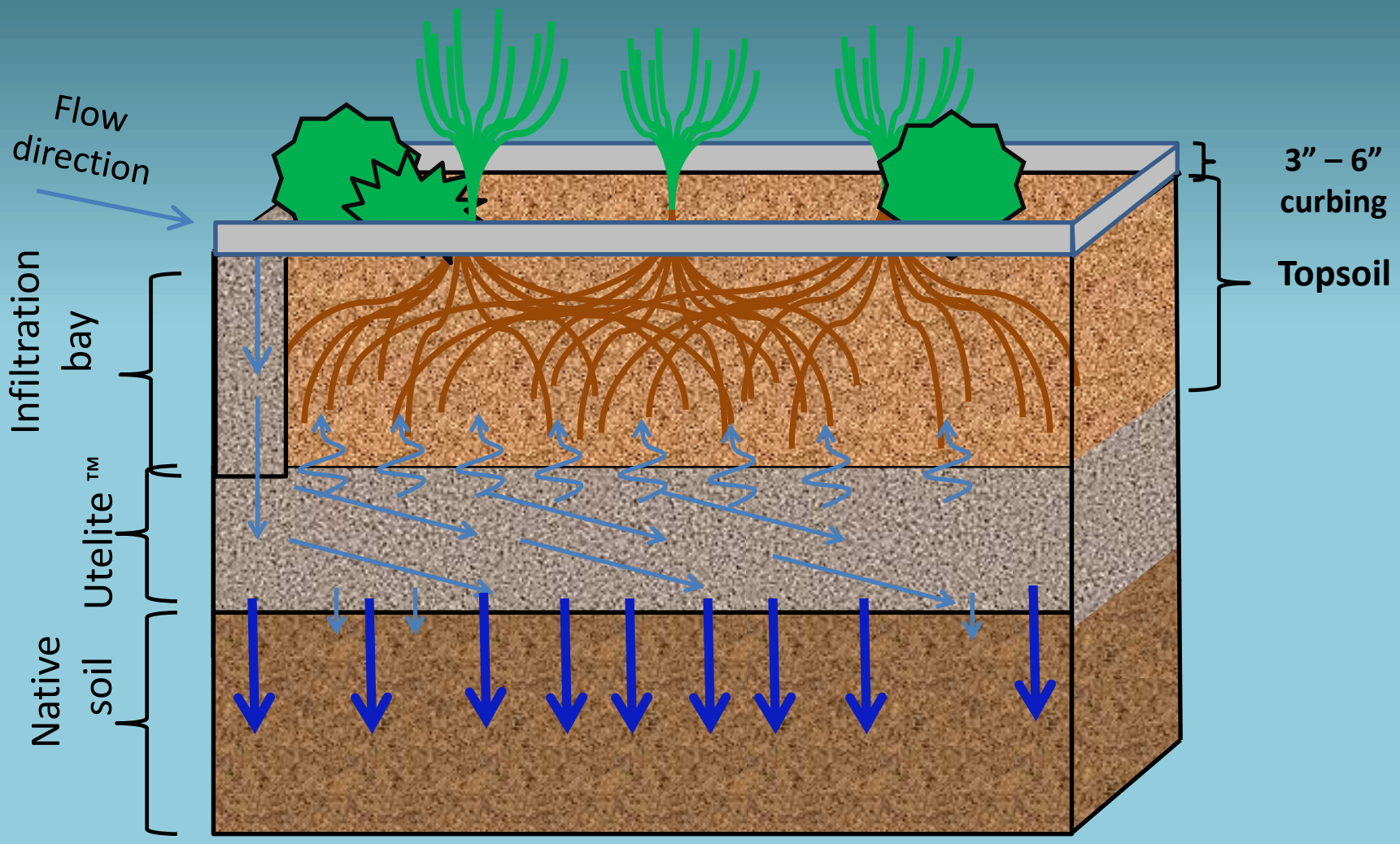
What is Bioretention?

"Green Infrastructure management approaches and technologies infiltrate, evapotranspire, capture and reuse stormwater to maintain or restore natural hydrologies" – EPA GI homepage

Wasatch Front Hydrology:

Winter = *precipitation, storage (snow, infiltration)*
Spring = *groundwater recharge, runoff*
Early Summer = *Plant transpiration rates high*
Late Summer = *deep-rooted plants access groundwater*
Fall = *some precipitation, plants go dormant before winter*

What is Bioretention?



Is Stormwater Bioretention Catching your Attention?

Department of
CIVIL & ENVIRONMENTAL ENGINEERING
THE UNIVERSITY OF UTAH

What is Bioretention?

Native plants do not require supplemental irrigation and grow extensive root systems to biologically treat pollutants

Is Stormwater Bioretention Catching your Attention?

What are we doing at the U?

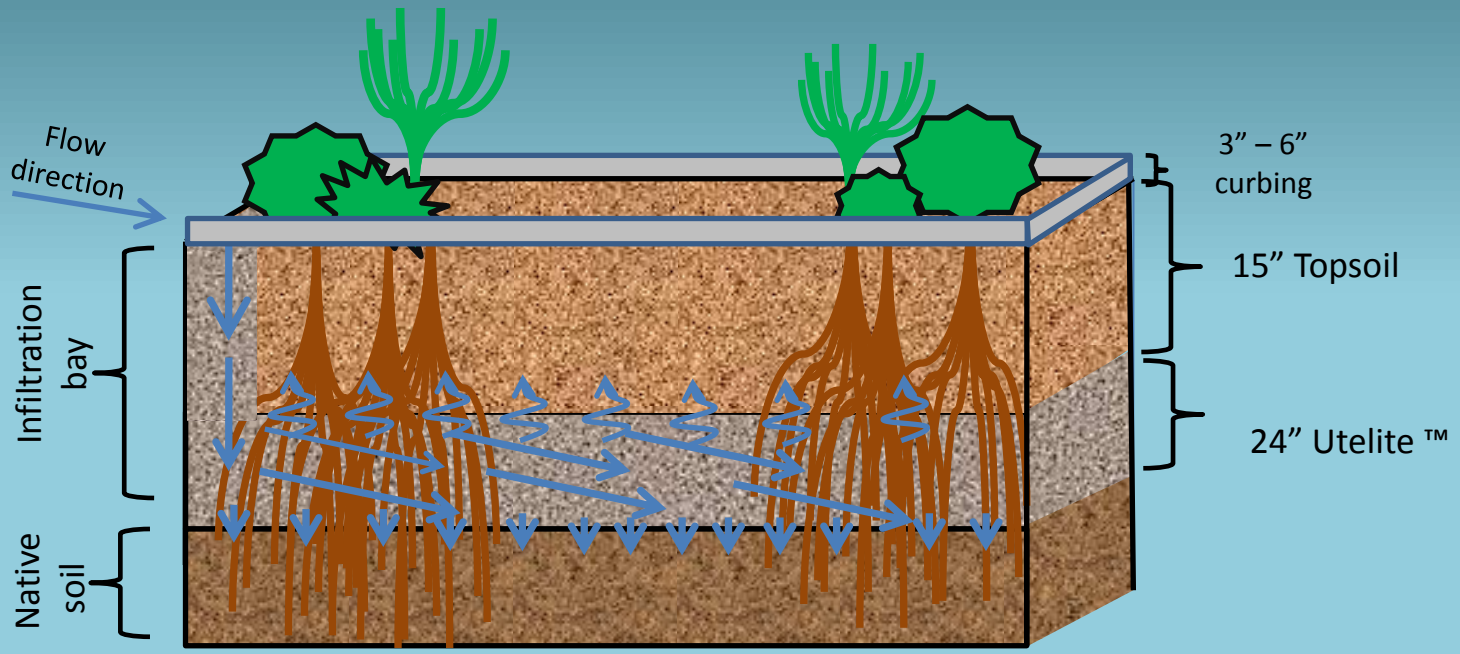
Research Questions

Our climate is different than other places where Bioretention works, will it work here?

- How do we design the layers to maximize treatment?
- How big do we design bioretention?
- Where does the water go?
- What plants do we use?
- Do we get enough water to sustain plants?
- Do these systems reduce pollution loading to receiving waters?
- Where does this pollution go?
- How much does bioretention cost?

What are we doing at the U?

- **How do we design the layers to maximize treatment?**

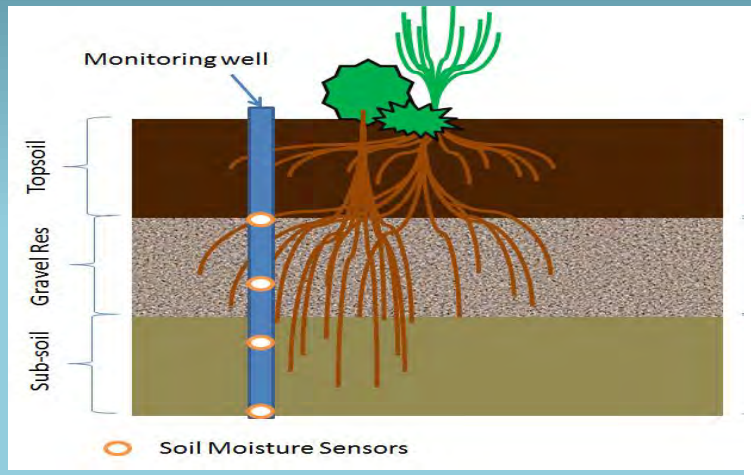


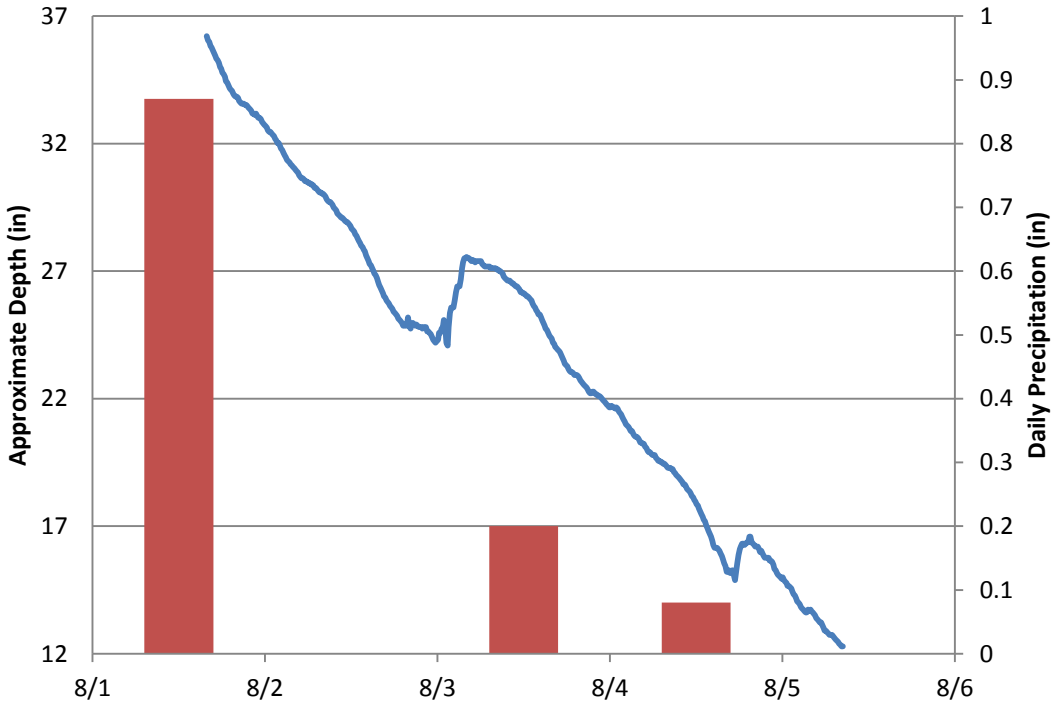
1. Gravel infiltration bay to promote flow of small runoff events to storage layer
2. No liner or underdrain to maximize infiltration into native soils
3. Weed barrier under decorative rocks replace mulch to minimize evaporative loss of shallow water moisture and weed growth
4. Deep-rooted native plants that can access infiltrated water in summer
5. Curbs act as flood containment in big storms, roots act to promote infiltration rates

What are we doing at the U?

- **Where does the water go?**

SCIF Bioretention 3 – Quantifying the direction & rate of infiltration in Bioretention





What are we doing at the U?

- **How big do we design bioretention?**

  Sustainable Campus Initiative Fund (SCIF) Bioretention 1

1500 ft² garden treats up to 1" of runoff from 25,000 ft²

What are we doing at the U?

- **What Plants do we use?**

Species name	Common Name	Form	Rooting Pattern
Schizachyrium scoparium	Little bluestem	Bunchgrass	Extensive
Bouteloua gracilis	Blue gramma	Bunchgrass	Extensive
Sorghastrum nutans	Indiangrass	Bunchgrass	Extensive
Pascopyrum smithii	Western Wheat Grass	Bunchgrass	Extensive
Pseudoroegneria spicata	Bluebunch Wheat Grass	Bunchgrass	Extensive
Rosa woodsii	Wood rose	Shrub	Extensive
Rhus Aromatica	Fragrant sumac	Shrub	Extensive
Fallugia paradoxa	Apache plume	Shrub	Extensive
Chrysothamnus nauseosus	Rubber rabbitbrush	Shrub	Deep
Atriplex canescense	Four-winged saltbrush	Shrub	Deep
Juniperus osteosperma	Utah Juniper	Tree	E and D
Cercocarpus ledifolius	Curly mahogany	Tree	Deep
Artemisia tridentata	Sagebrush	Shrub	E and D
Cercocarpus montanus	Mountain mahogany	Shrub	E and D
Eschscholzia californica	California Poppy	Flower	E and D
Epilobium angustifolium	Fireweed	Flower	Extensive
Tulipia sp.	Tulips	Flower	Bulb
Delphinium bicolor	Low larkspur	Flower	Extensive

What are we doing at the U?

- **Do we get enough water to sustain plants?**

  SCIF Bioretention 2 – irrigation methods to establish bioretention

What are we doing at the U?

- **Do these systems reduce pollution loading to receiving waters?**
- **Where does this pollution go?**

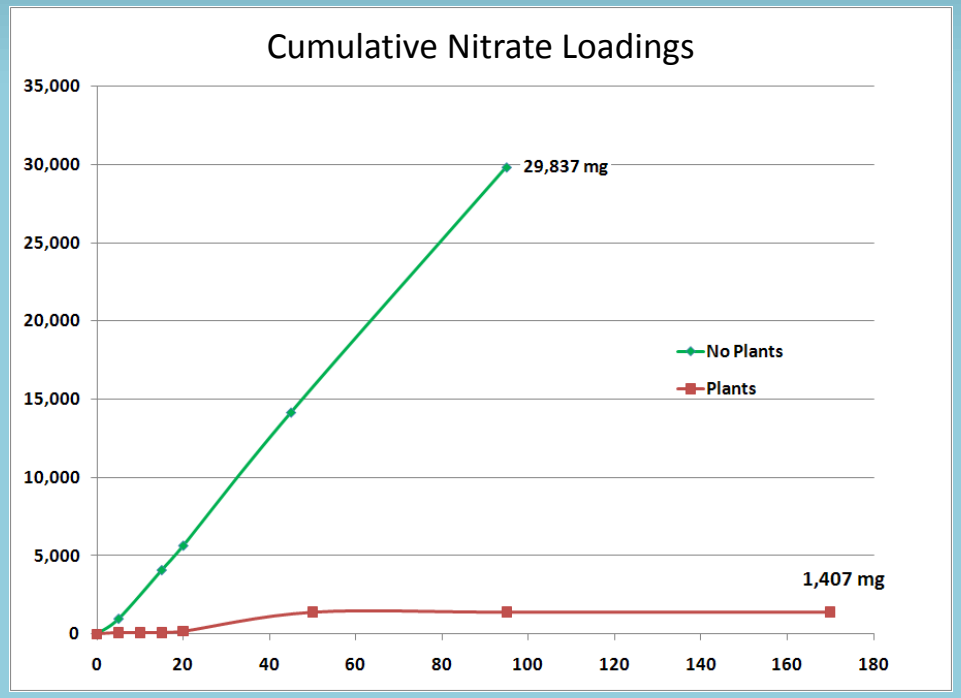
National Science Foundation Grant

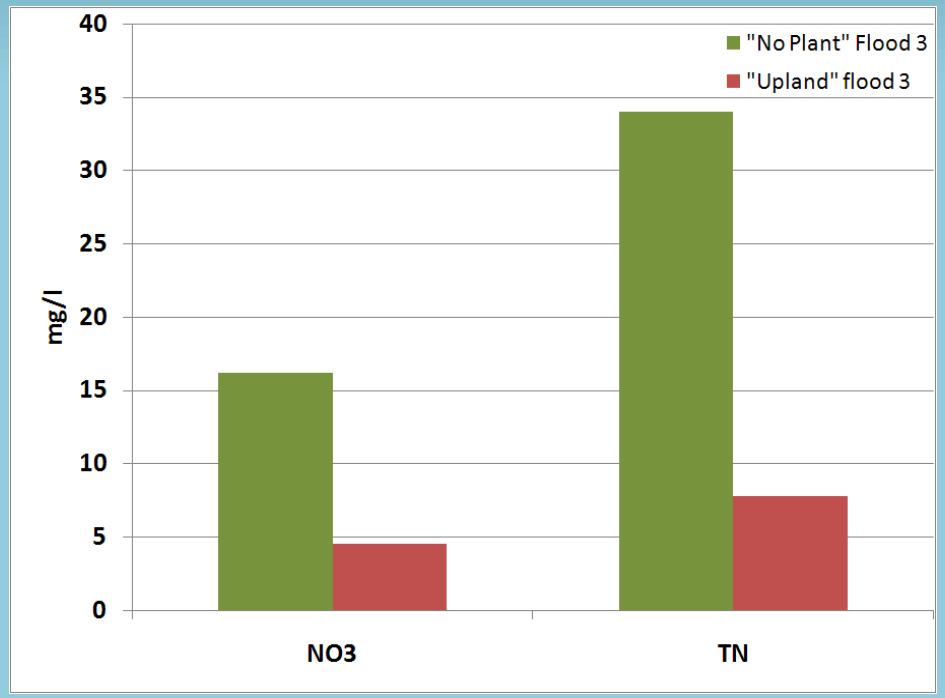
- Testing three ecosystem types
- Mass removal of Nitrogen and Phosphorus
- Cost of treatment per gallon of water needed for irrigation
- Stable Isotope Tracer experiments
- Partnership with SIRFER, Biology Department

What are we doing at the U?

- Do these systems reduce pollution loading to receiving waters?
- Where does this pollution go?

National Science Foundation Grant





Is Stormwater Bioretention Catching your Attention?

Department of
CIVIL & ENVIRONMENTAL ENGINEERING
THE UNIVERSITY OF UTAH

What are we doing at the U?

- **Do these systems reduce pollution loading to receiving waters?**
- **Where does this pollution go?**

National Science Foundation Grant

- Testing three ecosystem types
- Mass removal of Nitrogen and Phosphorus
- Cost of treatment per gallon of water needed for irrigation
- Stable isotope tracer experiments
- Partnership with SIRFER, Biology Department

What are we doing at the U?

- **How much does bioretention cost?**

  Water Environment Research Foundation Cost Tool

  http://www.werf.org/bmpcost

	A	B	C	D	E
1	**Curb-Contained Bioretention**				
2	**CAPITAL COSTS**			**Choose Capital Costing Option**	
3	**Site Name: Webinar Demo**			**A**	**Total Facility Cost**	**$ 118,223**
4	**Site Location: National Average**			**"A"** - Simple Cost based on Drainage Area	
5	**Date:May, 2009**			**"B"** - User-Entered Engineer's Estimate	
6					
7	**Method A: Simple Cost Based on Drainage Area**				
8	**Cost Based on Drainage Area**		**Model Default**	**User**	**Chosen Option**
9					
10	Effective Drainage Area (DA) (acres)		0.80		0.93
11	Suggested Garden Size (SF)		2,500		2,900
12	Base Facility Cost ($/acre effective DA)		$ 42,254		$ 86,252
13	**Base Facility Cost**		**$ 33,900**		**$ 80,300**
14	Engineering & Planning (default = 25% of Base Cost)		$ 8,475		$ 20,075
15	Cost Adjustment for Retrofit		$ 0		$ 12,848
16	Land Cost		$ 0		$ 0
17	Other Costs		$ 0	$ 5,000	$ 5,000
18	**Total Associated Capital Costs (e.g., Engineering, Land, etc.)**		**$ 8,475**		**$ 37,923**
19	**Total Facility Cost**		**$ 42,375**		**$ 118,223**

1.Design & Maintenance Options | 2.Capital Costs | 3.Maintenance Costs | 4.Cost Summary | 5.Whole Life Cos

What are we doing at the U?

WE NEED YOUR HELP!!!!

If you are interested, we need collaborators to:

- Provide sites to install more facilities for monitoring
- Improve design including site-specific sizing and plant selection
- Work to create local regulations that promote bioretention
- Participate in up-coming bioretention workshops sponsored by AWRA and the NSF

Christine Pomeroy, Ph.D., P.E.

Christine.Pomeroy@utah.edu

Department of
CIVIL & ENVIRONMENTAL ENGINEERING
THE UNIVERSITY OF UTAH

What are we doing at the U?

WE NEED YOUR HELP!!!!

If you are interested, we need collaborators to:

- Provide sites to install more facilities for monitoring
- Improve design including site-specific sizing and plant selection
- Work to create local regulations that promote bioretention
- Participate in up-coming bioretention workshops sponsored by AWRA and the NSF

Christine Pomeroy, Ph.D., P.E.

Christine.Pomeroy@utah.edu

Department of
CIVIL & ENVIRONMENTAL ENGINEERING
THE UNIVERSITY OF UTAH