Evaluating Stormwater Solutions in Ohio's Lake Erie Basin

Collaborative Learning Group meeting

October 18, 2012

NATIONAL ESTUARINE RESEARCH RESERVE OLD WOMAN CREEK OHIO DIVISION OF WILDLIFE

OHIO DEPARTMENT OF NATURAL RESOURCES

OHIO DEPARTMENT OF NATURAL RESOURCES DIVISION OF WILDLIFE

SOIL AND WATER RESOURCES Ohio Department of Natural Resources

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION NOAA U.S. DEPARTMENT OF COMMERCE

Erie Soil & Water Conservation District

COASTAL TRAINING PROGRAM OHIO

Firelands Coastal Tributaries Watershed Project

cbi Consensus Building Institute

Welcome

1. Introductions
2. Meeting objectives
3. Site visit wrap up

Meeting Objectives

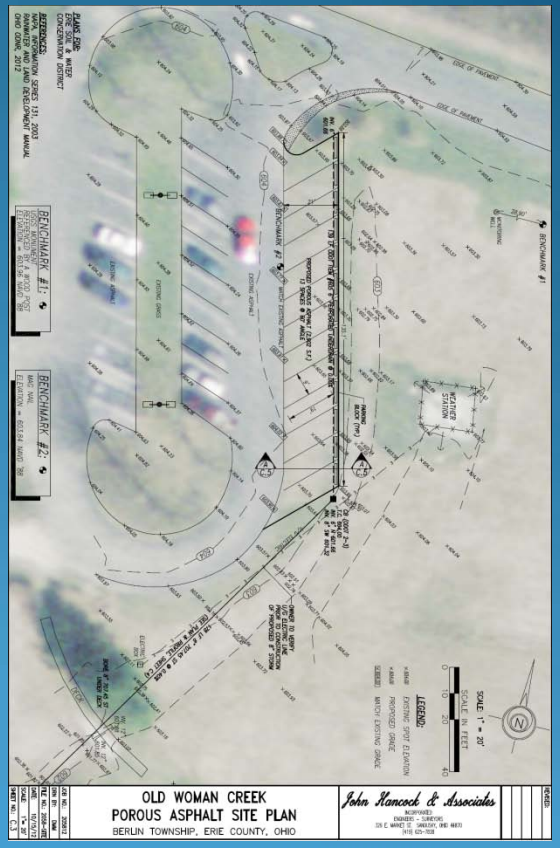
- Visit Old Woman Creek Reserve and discuss planned stormwater designs
- Review swale types and functionality
- Discuss monitoring work getting underway
- Provide participants with updates on current project activities including design assistance

Old Woman Creek NERR

- Contracts complete

- Project kickoff meeting completed
  - Aligned partner expectations and agreed to move forward
  - Infiltration tests (2) - <.005 in/hour
  - Site survey complete
  - Conceptual plan drafted
    - Reviewed by PT, NCSU, OEPA, CLG

- Next steps:
  - Develop design
  - Design review by PT, CLG, NCSU & Ohio EPA



Site Visit Wrap Up

- Final thoughts regarding proposed porous asphalt parking area?
- Questions about Old Woman Creek NERR programs?

Swale Design Presentation and Discussion

Jay Dorsey, ODNR Division of Soil & Water Resources
Ona Ferguson, Consensus Building Institute

Swale & Basin Definitions

Stormwater basins are impoundments or excavated basins for the short term detention of stormwater runoff. These structures hold and release the water through a controlled outlet over specified time period based on the design criteria.

==========

Swale - a shallow ditch used to carry away water

Vegetated swales (a.k.a. grassed channel, dry swale, wet swale or biofilter) are constructed open-channel drainageways used to convey stormwater runoff. They do not pond water for a long period of time.

BMP Categories

- Basins
  - Wet Pond (detention, sedimentation)
  - Stormwater Wetland (detention, sedimentation)
  - Stormwater Vaults (detention, sedimentation)
  - Dry Pond (detention, sedimentation, infiltration)
  - Underground Detention/Retention (detention, sedimentation, infiltration)
  - Infiltration Basin (infiltration, sedimentation, detention)
  - Infiltration Trench (infiltration, sedimentation)
- Media Filters (and Basins w/Media Filters)
  - Pervious Pavement (filtration, detention, sedimentation, infiltration)
  - Bioretention (filtration, sedimentation, infiltration)
  - Sand Filter (filtration, sedimentation, infiltration)
- Flow-through Practices
  - Swale (flow rate attenuation, sedimentation, infiltration)
  - Filter Strip (sedimentation, flow rate attenuation, infiltration)
- Source Area Enhancement
  - Soil Profile/Soil Quality Improvement (infiltration)
  - Green Roof (infiltration/abstraction)

Approved WQv BMPs
(OEPA 2008 Construction SW Permit)

Table 2
Structural Post-Construction BMPs & Associated Drain (Drawdown) Times

Best Management Practice	Drain Time of WQv
Infiltration Basin^	24 - 48 hours
Enhanced Water Quality Swale	24 hours
Dry Extended Detention Basin*	48 hours
Wet Extended Detention Basin**	24 hours
Constructed Wetland (above permanent pool)+	24 hours
Sand & Other Media Filtration	40 hours
Bioretention Cell^	40 hours
Pocket Wetland#	24 hours
Vegetated Filter Strip	24 hours

* Dry basins must include forebay and micropool each sized at 10% of the WQv
** Provide both a permanent pool and an EDv above the permanent pool, each sized at 0.75 * WQv
+ Extended detention shall be provided for the full WQv above the permanent water pool.
^ The WQv shall completely infiltrate within 48 hours so there is no standing or residual water in the BMP.
# Pocket wetlands must have a wet pool equal to the WQv, with 25% of the WQv in a pool and 75% in marshes. The EDv above the permanent pool must be equal to the WQv.

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Swale w/24 hour Drain Time

Velocity (v) = Length (L)/Time (t)

Length (L) = Velocity (v) * Time (t)

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From TR-55, $v = 16.1 * (s)^{0.5}; at\ 1\%\ slope\ v = 16.1 * (0.01)^{0.5} = 1.6\ \frac{ft}{s}$

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From TR-55, $v = 16.1 * (s)^{0.5}; at\ 1\%\ slope\ v = 16.1 * (0.01)^{0.5} = 1.6\ \frac{ft}{s}$

$$L = v * t = 1.6\ \frac{ft}{s} * 24\ hr\ * 3600\ \frac{s}{hr} = 138{,}240\ ft\ * \frac{mi}{5280\ ft} = 26.2\ miles$$

When a “Swale” Isn’t a Swale

Enhanced
Dry Swale

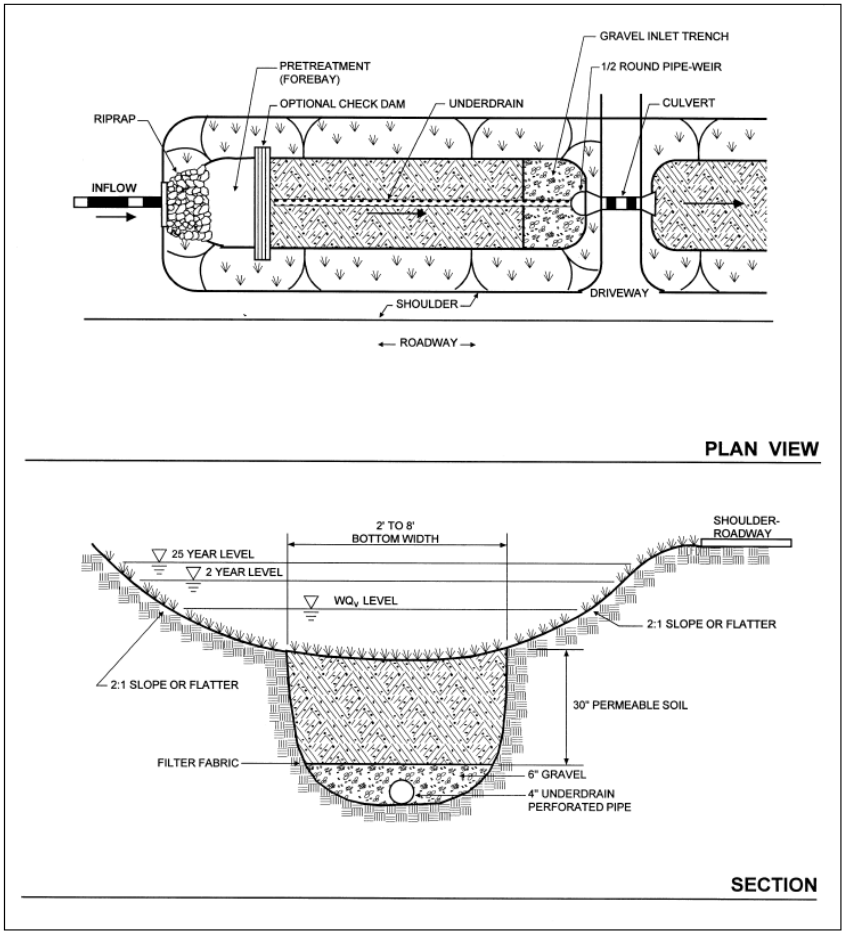


Figure 3.2.6-2 Schematic of Dry Swale

(Source: Center for Watershed Protection)

When a “Swale” Isn’t a Swale

Enhanced
Dry Swale

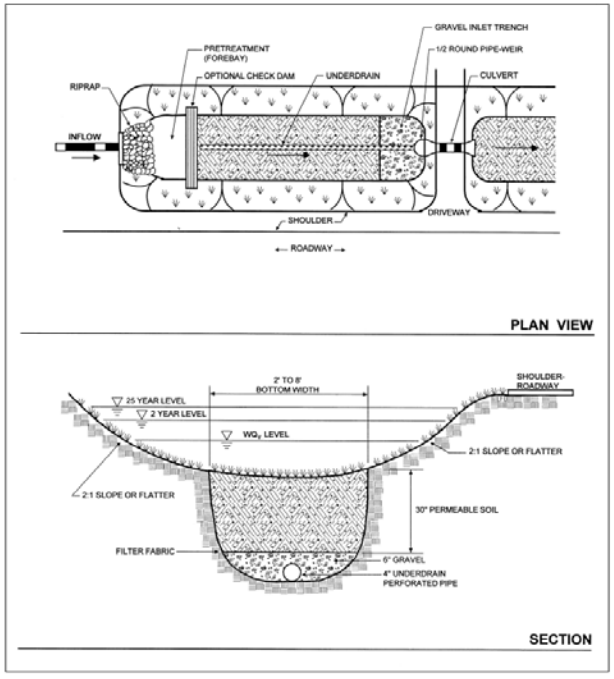


Figure 3.2.6-2 Schematic of Dry Swale
(Source: Center for Watershed Protection)

VIRGINIA DCR STORMWATER
DESIGN SPECIFICATION No. 10

DRY SWALES

VERSION 1.9
March 1, 2011

SECTION 1: DESCRIPTION

When a "Swale" Isn't a Swale

Enhanced
Dry Swale

Dry swales are essentially bioretention cells that are shallower and covered with turf … The dry swale temporarily stores and then filters the Water Quality Volume (WQv)

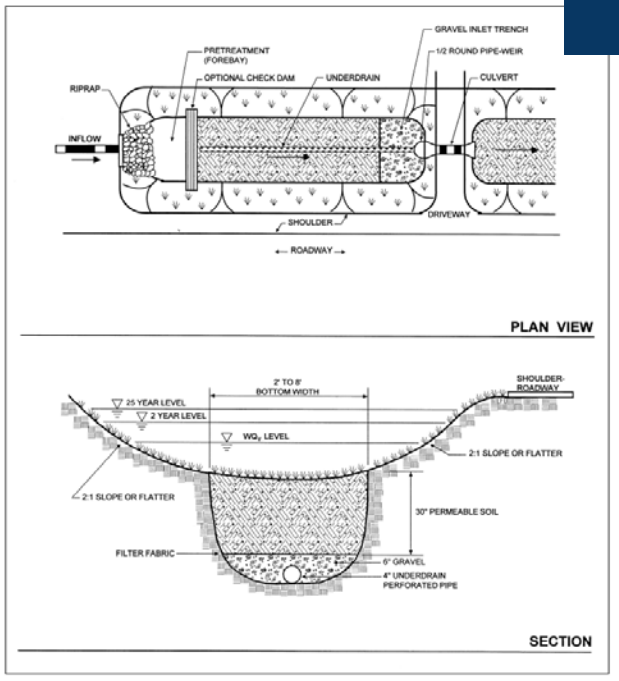


Figure 3.2.6-2 Schematic of Dry Swale

(Source: Center for Watershed Protection)

SECTION 1: DESCRIPTION

Grassed Bioretention

Cleveland, OH

Oberlin, OH

How about “Swales” that Are Swales?

4.1 Grassed Swale

Description

Grassed swales are constructed channels shaped and established with suitable vegetation in order to convey stormwater runoff without allowing channel erosion.

How about “Swales” that Are Swales?

VIRGINIA DCR STORMWATER
DESIGN SPECIFICATION No. 3

GRASS CHANNELS

VERSION 1.9
March 1, 2011

SECTION 1: DESCRIPTION

Grass swales “provide a modest amount of runoff filtering and volume attenuation within the stormwater conveyance system”

SECTION 4: TYPICAL DETAILS

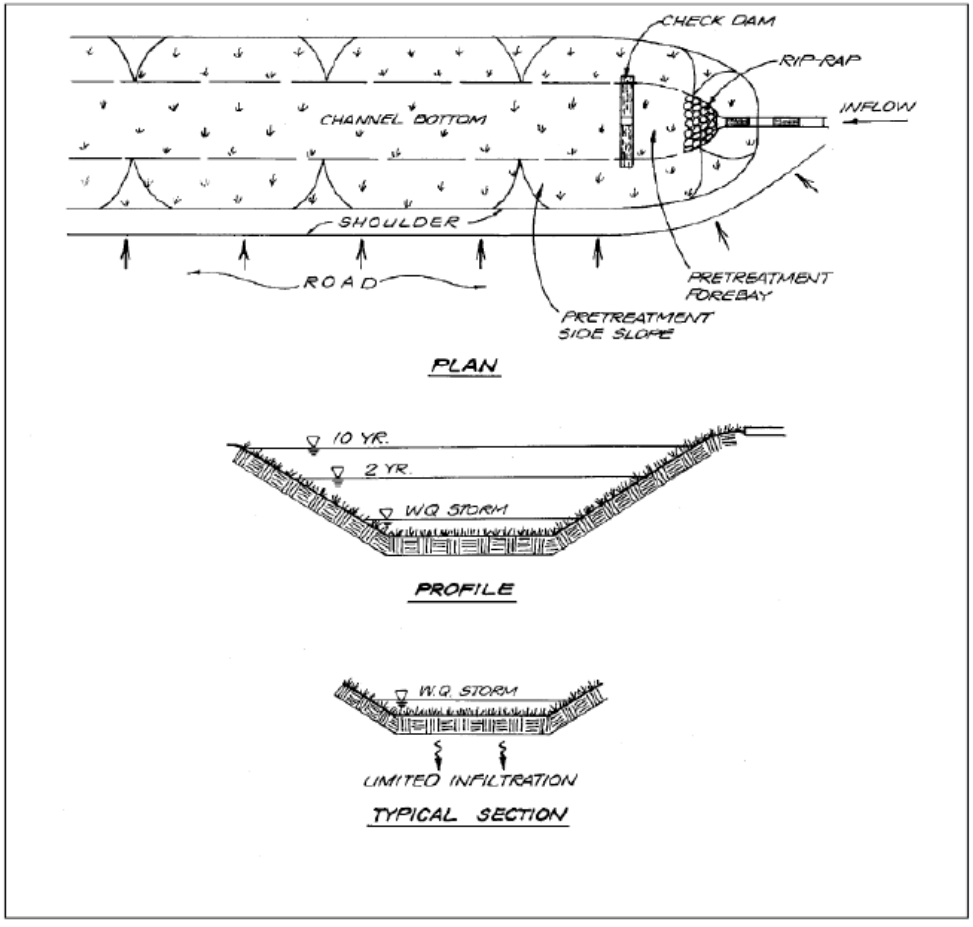


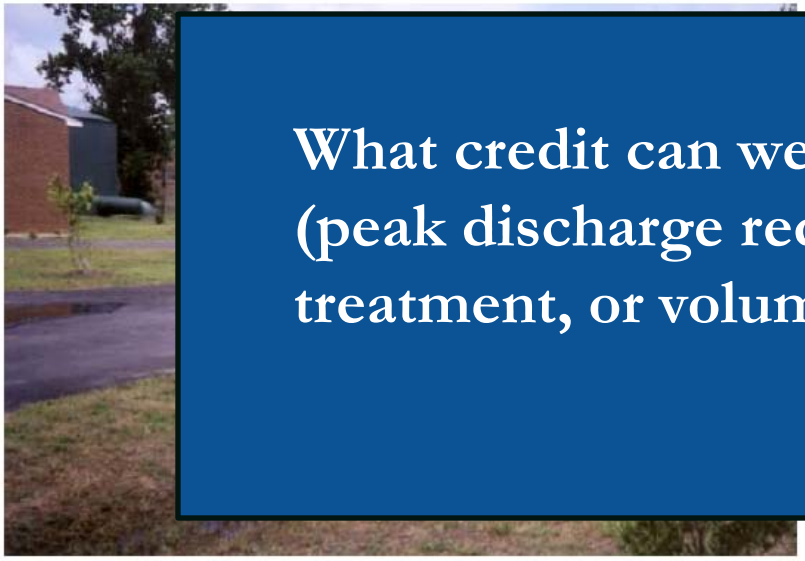
Figure 3.1. Grass Channel – Typical Plan, Profile and Section

How about “Swales” that Are Swales?

VIRGINIA DCR STORMWATER
DESIGN SPECIFICATION No. 3

GRASS CHANNELS

VERSION 1.9
March 1, 2011



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SECTION 4: TYPICAL DETAILS

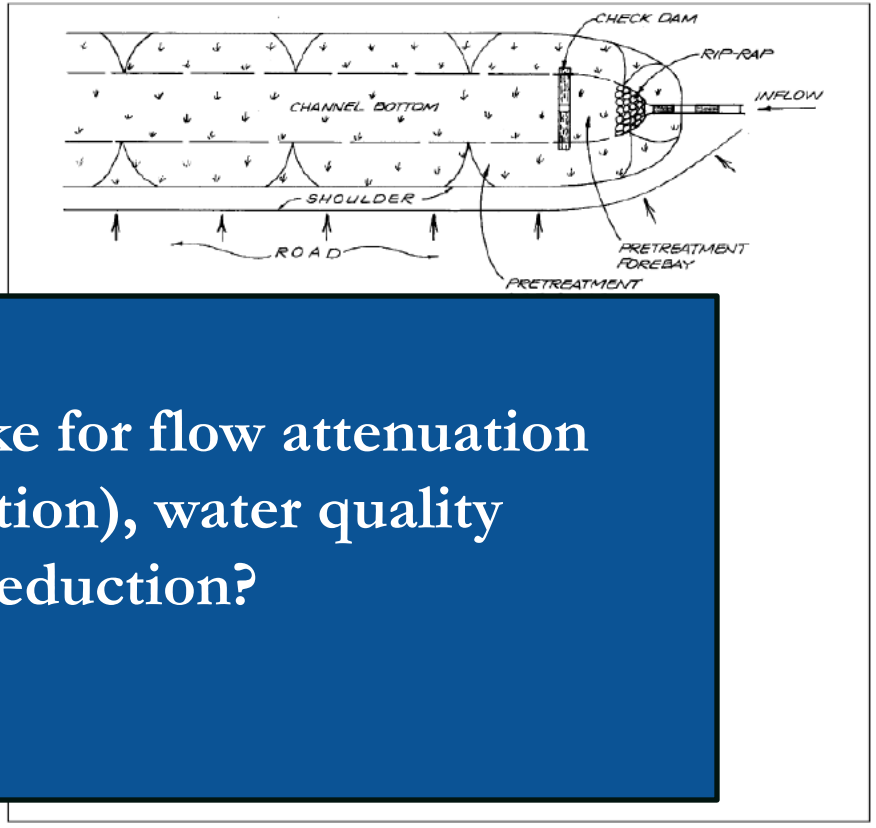


Figure 3.1. Grass Channel – Typical Plan, Profile and Section

What credit can we take for flow attenuation (peak discharge reduction), water quality treatment, or volume reduction?

WV Runoff Reduction Method Spreadsheet

Grassed Swale

4. Grass Channel		
Grass Channel A/B Soils	Reduce volume conveyed through grass channel by 20%.	20%
Grass Channel C/D Soils	Reduce volume conveyed through grass channel by 10%.	10%
Grass Channel with Compost Amended Soils	Reduce volume conveyed through grass channel by 30%.	30%
5. Dry Swale		
Dry Swale	Subtract 100% of the provided storage volume.	100%
6. Bioretention		
Bioretention	Subtract 100% of the provided storage volume.	100%

Grassed Bioretention

Swale Continuum

What values (functions and services) are provided by the swale, how do we quantify or credit those values, and how do we design for those values?

Design Variables that Influence Function

- Flow Rate/Residence Time
  - channel geometry
    - slope
    - channel shape (x-section)
    - flow depth
  - cover/channel roughness
- Infiltration Capacity
  - infiltration rate
  - soil drainage rate/available water storage

Swale Watershed Function Continuum

- Runoff Volume Reduction

- Water Quality Treatment

- Flow Attenuation/Peak Discharge Reduction

- Conveyance of a Specified Flow Rate
- Drainage

Swale Continuum

- Drainage – no specific criteria

Solon, OH

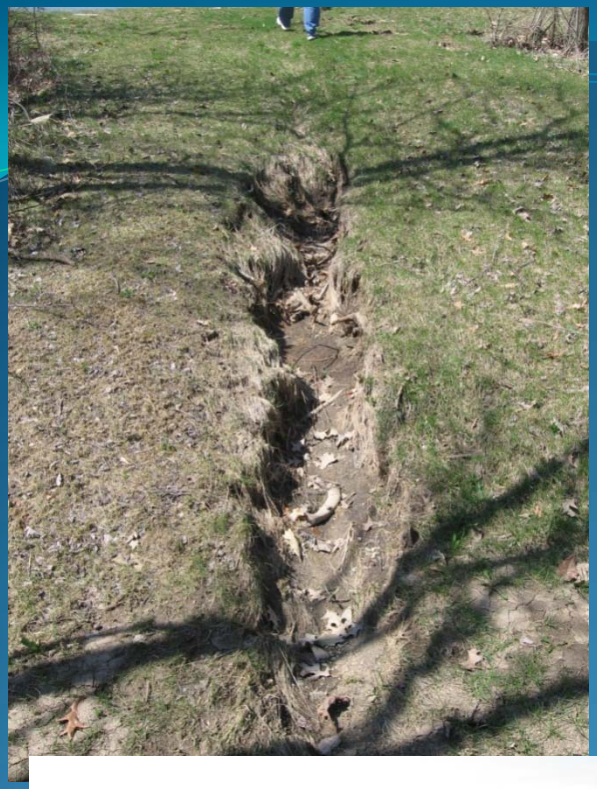
Westerville, OH

Columbus, OH

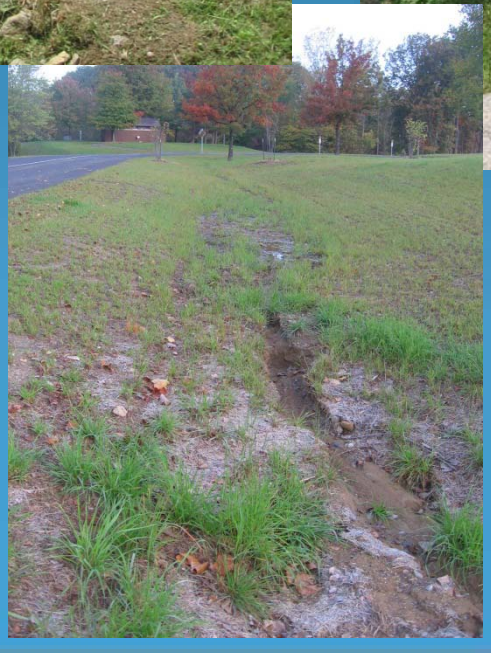
Columbus, OH

Swale Continuum

- Drainage
- Stability – sets maximum slope and/or flow volume based on maximum permissible velocities; requirement to incorporate subsurface drain



Knox County, OH



Knox County, OH

Licking County, OH

Swale Continuum

- Drainage
- Stability
- Conveyance/Flow Capacity – minimum channel size dictated by criteria to carry a particular design runoff event (e.g., 2-year storm), often with requirement to include extra space/depth ("freeboard") before the channel overtops

10/14/2009 01:11

Swale Continuum

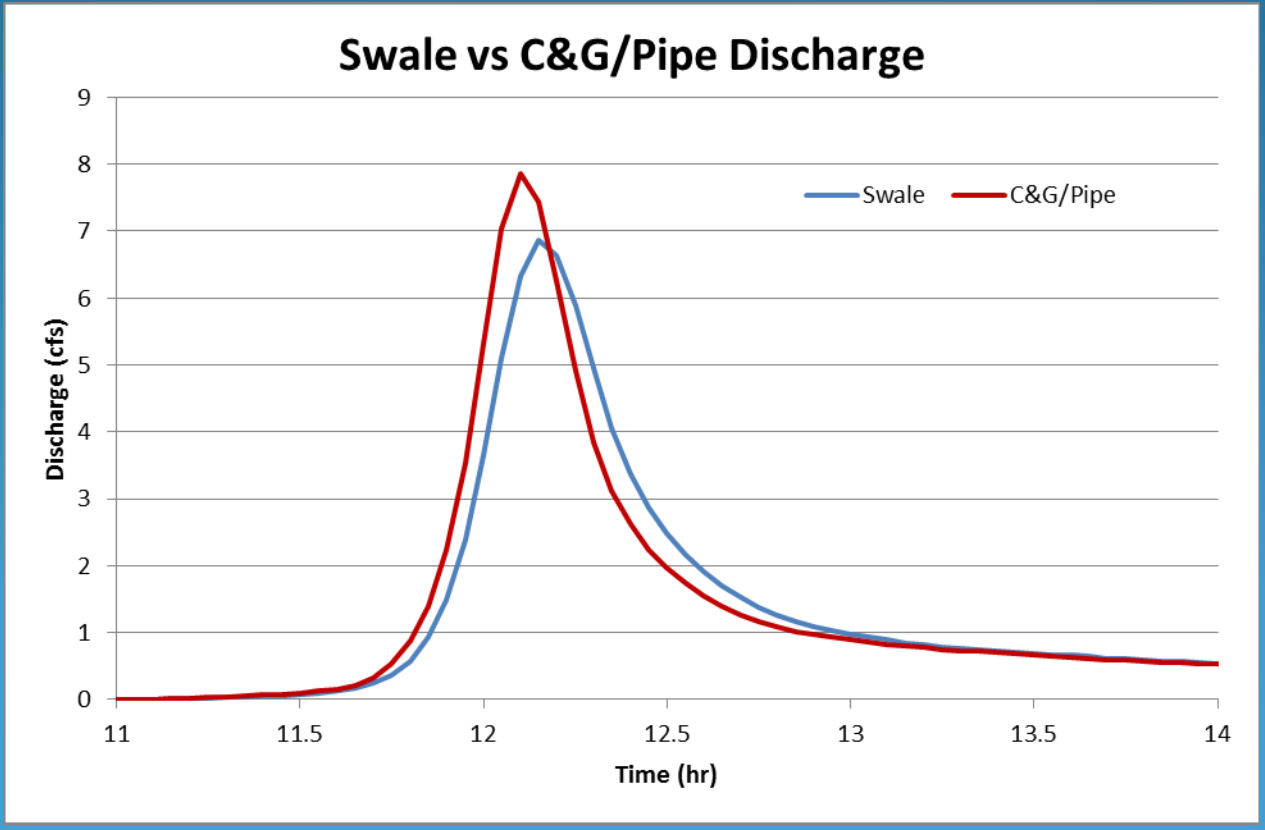
- Drainage
- Stability
- Conveyance/Flow Capacity
- Flow Attenuation (increased travel time) – varies based on site conditions, balancing peak discharge goals against other considerations ($$, aesthetics, zoning regs, etc.)

10/14/2009 01:11

Montgomery Co, MD
10/14/2009 01:14

Dublin, OH

Swale "Credit" for Peak Discharge Reduction



Swale Continuum

- Drainage
- Stability
- Conveyance/Flow Capacity
- Flow Attenuation
- Water Quality Treatment (including pretreatment for other BMPs) – sets a minimum "residence time" and maximum flow depth for the treatment volume

Design Variables that Influence Function

- Flow Rate/Residence Time
  - channel geometry
    - slope
    - channel shape (x-section)
    - flow depth
  - cover/channel roughness
- Infiltration Capacity
  - infiltration rate
  - soil drainage rate/available water storage

Tweaking Flow Rate/Residence Time

$$Q = vA$$

$$v = \frac{1.49}{n} R_h^{2/3} S^{1/2}$$

$$Q = \frac{1.49}{n} \frac{A^{5/3}}{P^{2/3}} S^{1/2}$$

To Increase Residence Time, Minimize Hydraulic Efficiency

- **maximize roughness (n)**
- **reduce slope S**
- **increase the ratio of the wetted perimeter (P) to the cross-sectional area (A)**

Tweaking Flow Rate/Residence Time

$$Q = vA$$

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Channel Slope (S)

Check Dams

Tweaking Flow Rate/Residence Time

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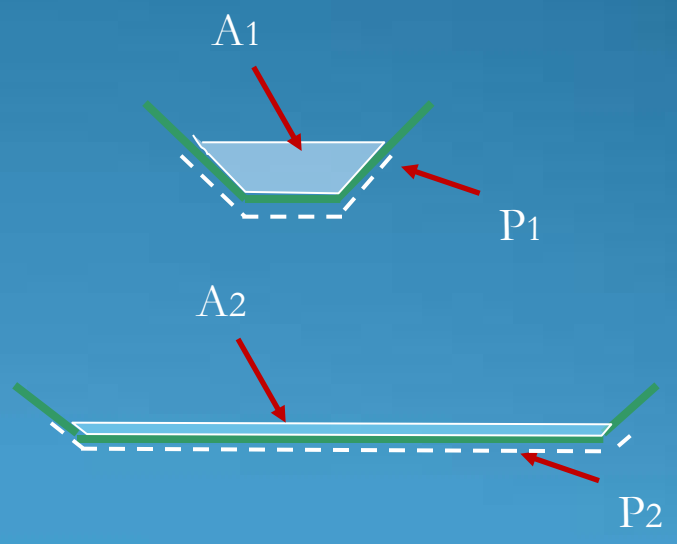
Increase the wetted perimeter (P) relative to the cross-sectional area (A)



Area $A_1 = A_2$

Wetted Perimeter $P_2 >> P_1$

Tweaking Flow Rate/Residence Time

Increase Manning's roughness (n)

$$Q = vA$$

$$v = \frac{1.49}{\boxed{n}} R_h^{2/3} S^{1/2}$$

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Increase Manning's roughness (n)

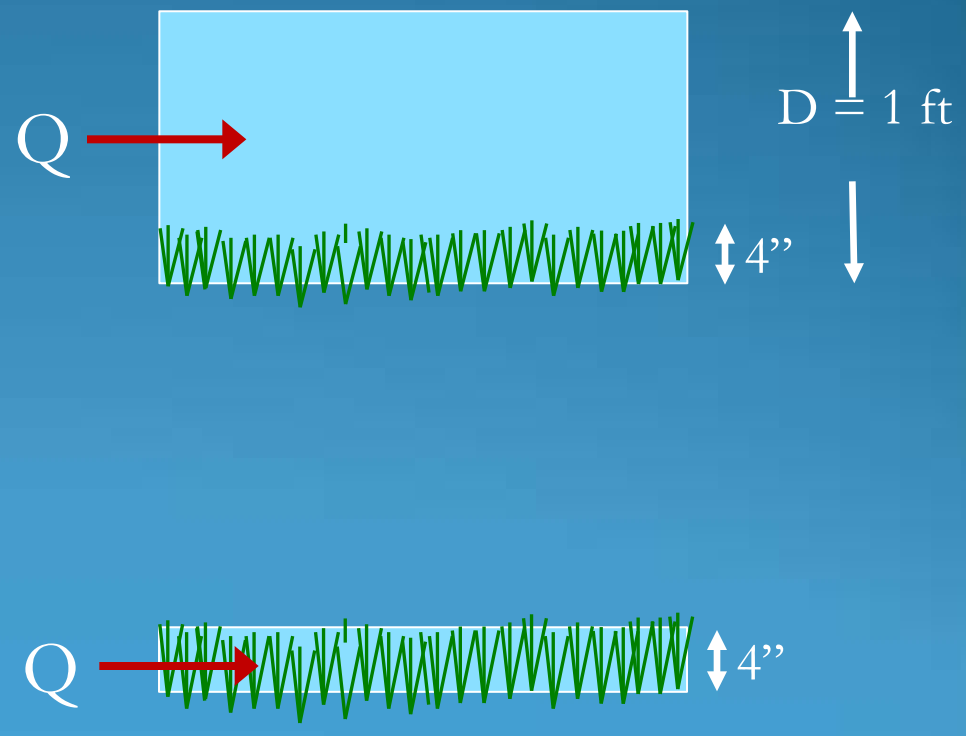
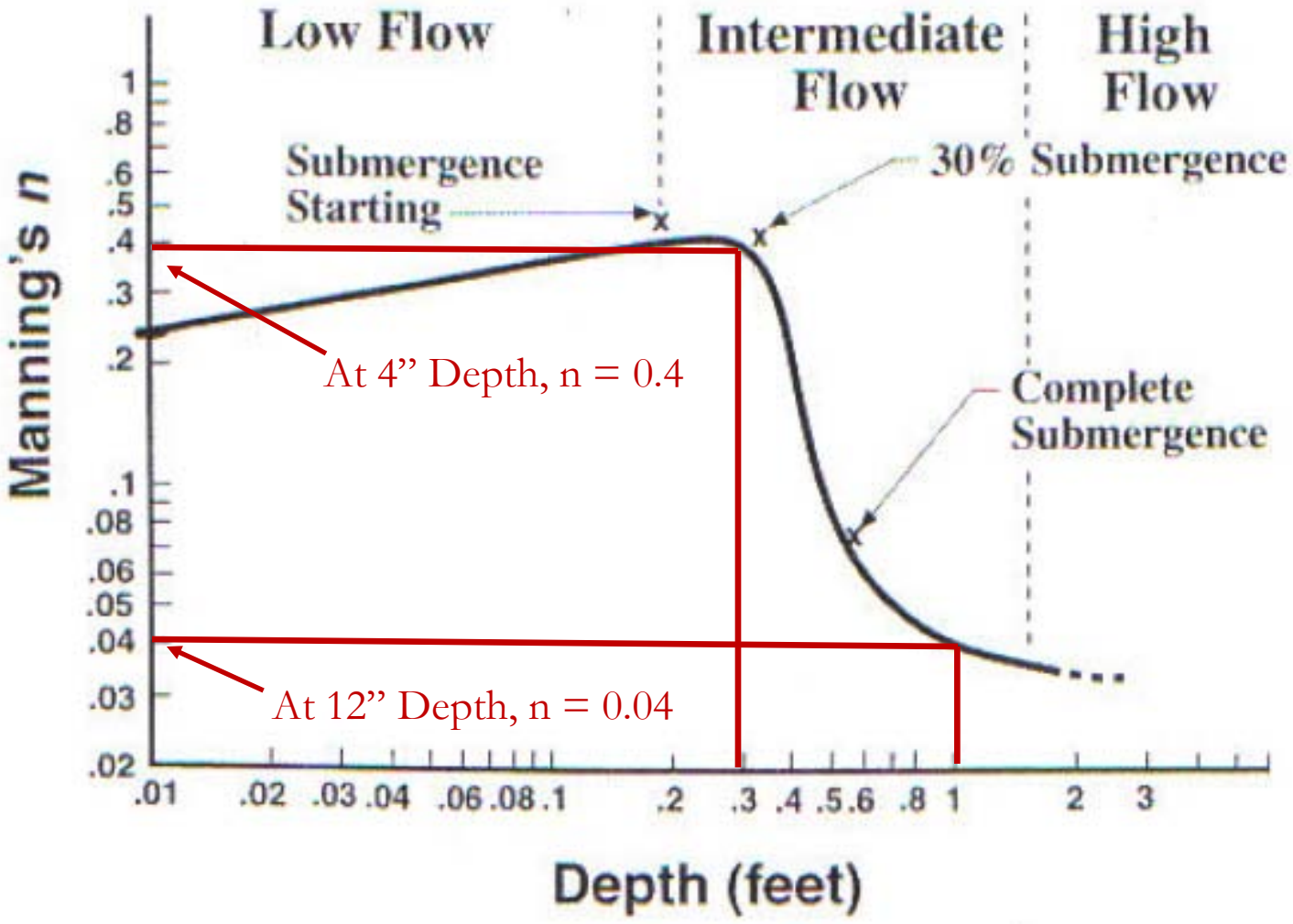


Figure 1: Manning's n Under Different Flow Depths



Source: Minton 2005

Tweaking Flow Rate/Residence Time

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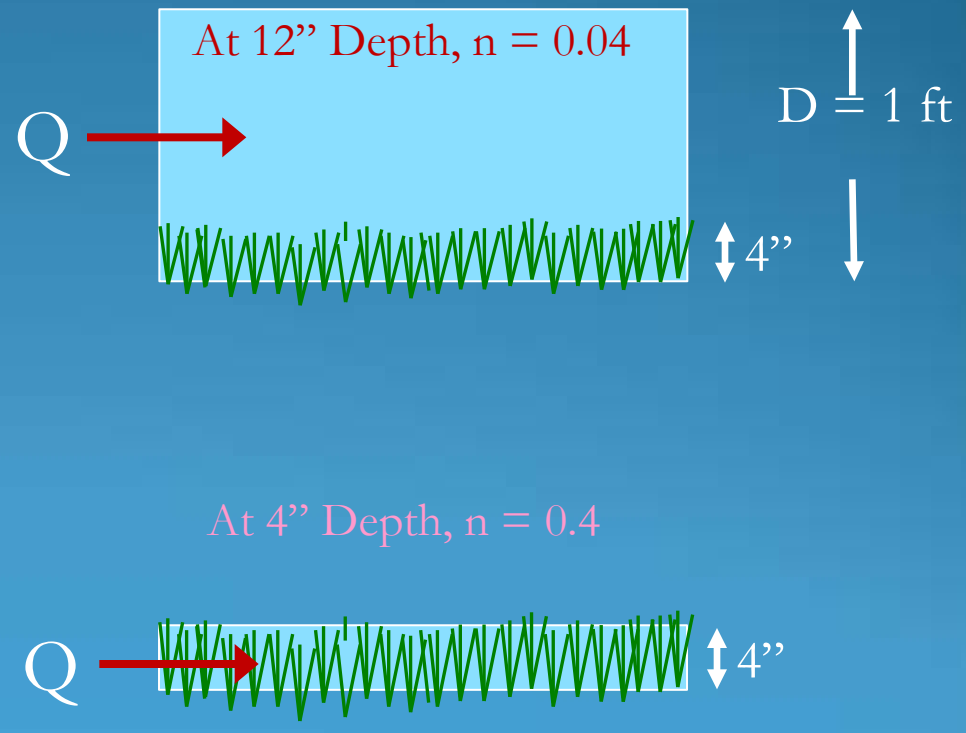
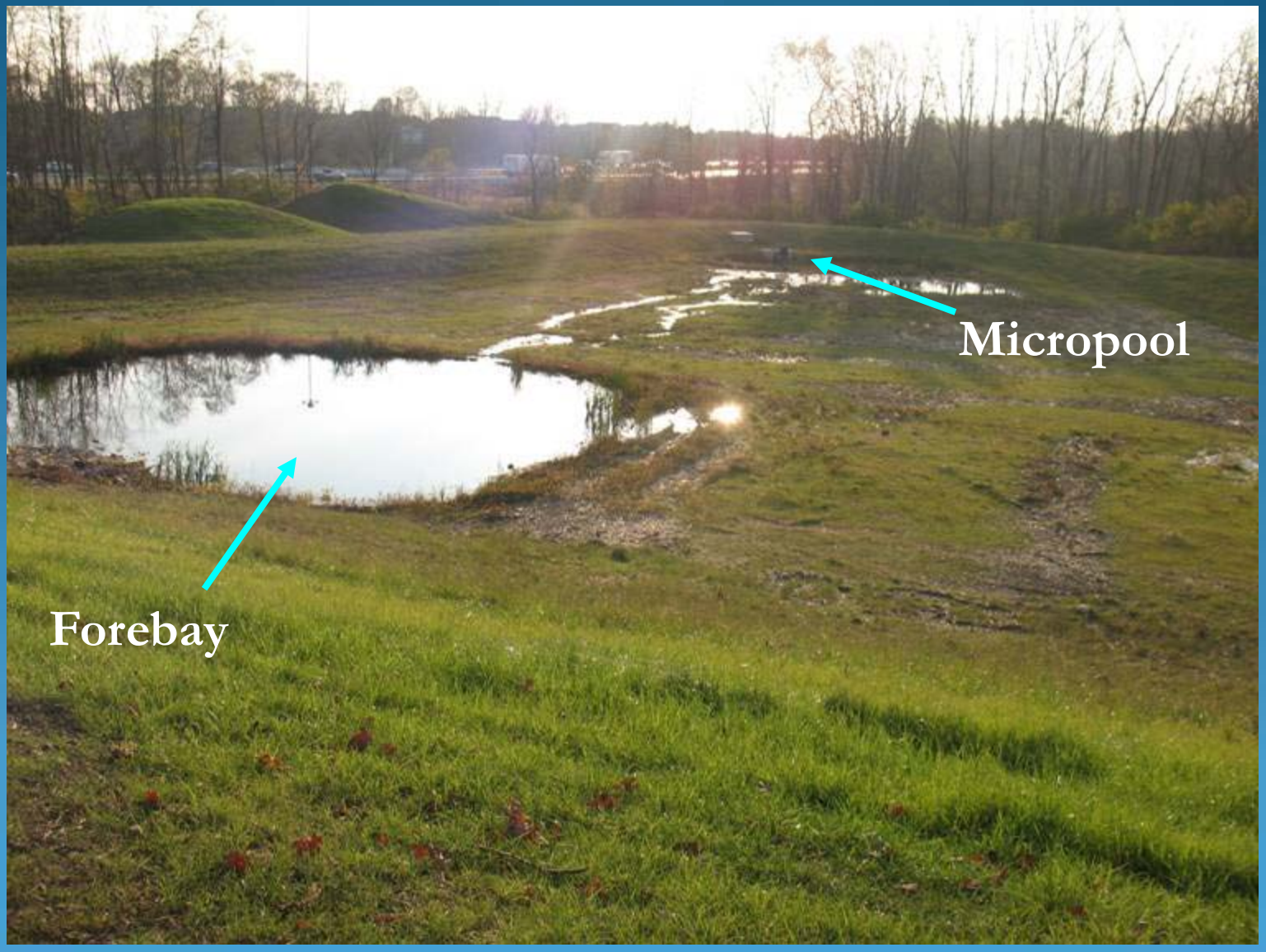


“Water Quality” Swale

- Uses
  - To obtain ~50% TSS reduction
    - Alone or as part of treatment train
    - Pre-treatment for bioretention or dry ponds
- Criteria
  - Max contributing drainage area < 5 acres
  - Longitudinal slope < 4%
  - Sideslopes 3:1 or flatter
  - Flow depth for WQv less than 3”
  - Hydraulic residence time > 9 minutes
  - 2-yr & 10-yr events non-erosive, 6” freeboard for 10-yr event

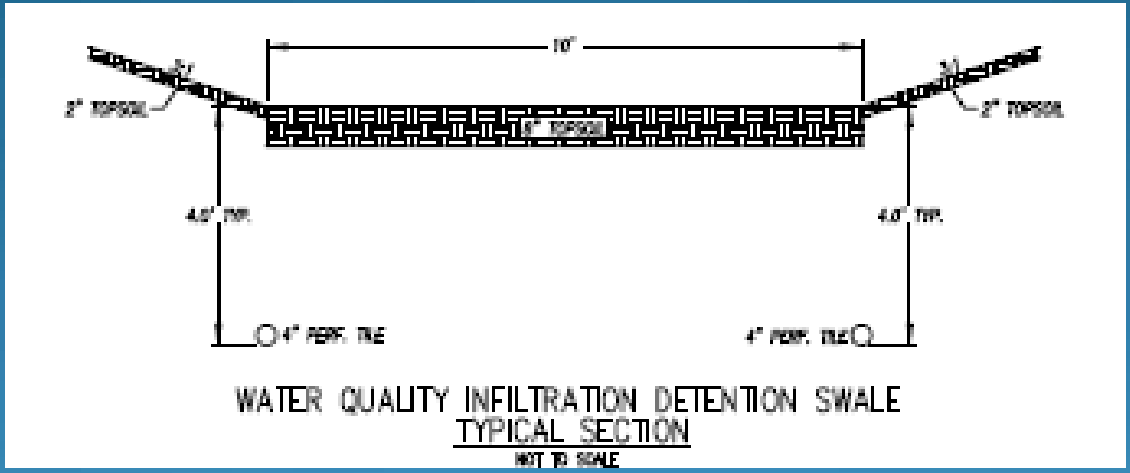
Swale “Credit” for Water Quality Pretreatment

Dry Pond Pretreatment - Forebay & Micropool



Dry Basin with Grass Swale Pretreatment

Perkins Swale



Perkins Swale (Swale 1 Only)

- Criteria
  - Max contributing drainage area < 5 acres **[~1.7 Ac]**
  - Longitudinal slope < 4% **[0.2%]**
  - Sideslopes 3:1 or flatter **[4:1?]**
  - Flow depth for WQv less than 3" **[3"]**
  - Hydraulic residence time > 9 minutes **[20 min]**
  - 2-yr & 10-yr events non-erosive, 6" freeboard for 10-yr event **[~0.9 ft freeboard @ 100-yr]**

Swale Continuum

- Drainage
- Stability
- Conveyance/Flow Capacity
- Flow Attenuation
- Water Quality Treatment
- Runoff Volume Reduction – sets minimum requirements to achieve a specific level of infiltration

“Infiltration Swale” and Credit for Volume Reduction

- Basis is Water Quality Swale Design
- Enhancements to Increase Infiltration Capacity
  - Soil Amendment or Replacement
  - Drain Tile
- NERRS Project
  - Where Perkins Twp Swale fits in
  - Hydrologic Monitoring
  - Opportunity for DRAINMOD/SWMM modeling

How about “Swales” that Are Swales?

Vegetated Infiltration Swale

(1005)

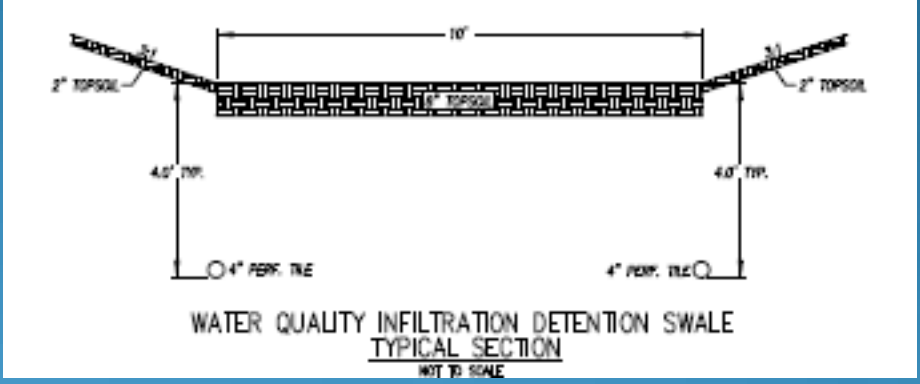
Interim Technical Standard

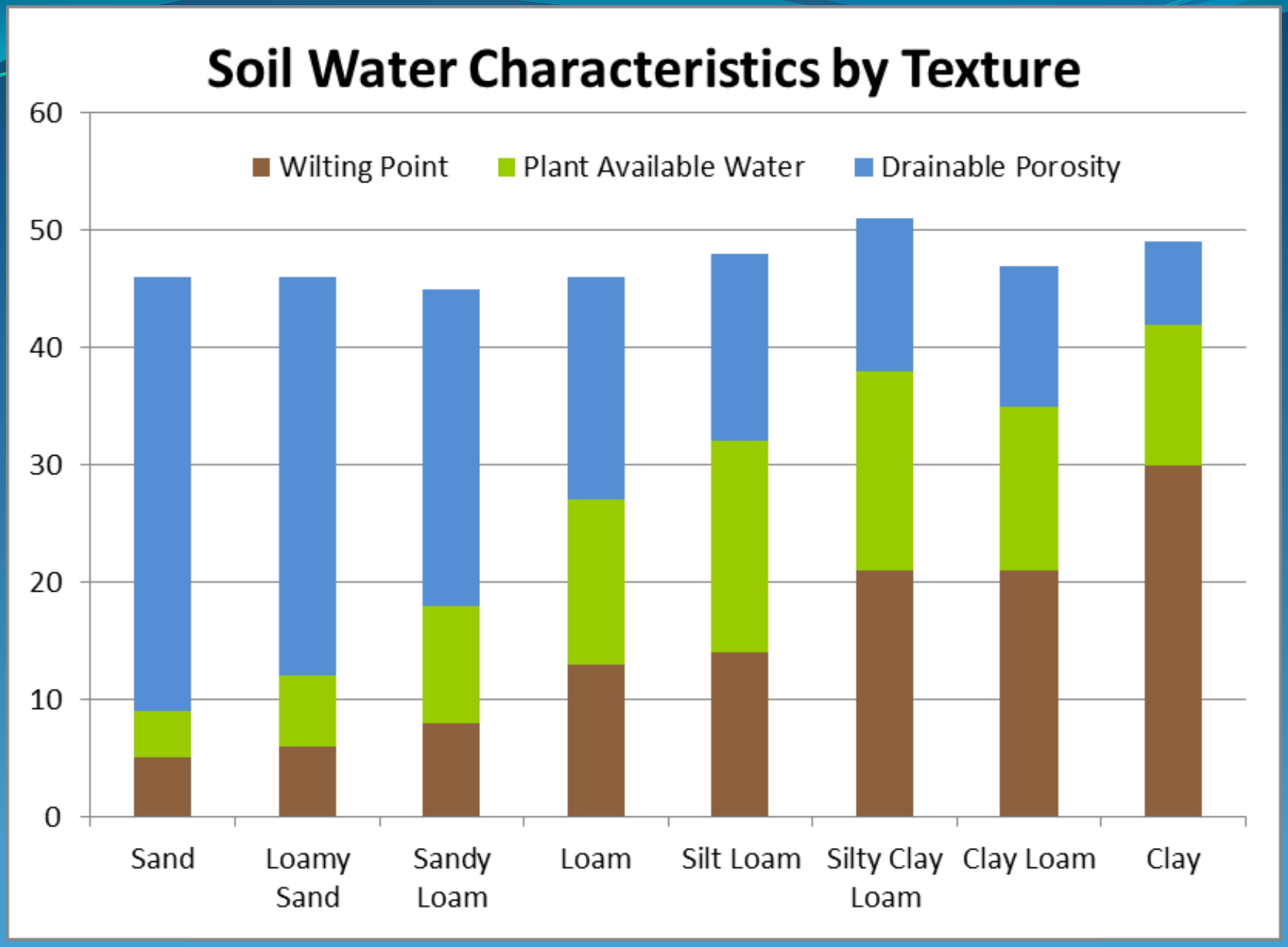
Wisconsin Department of Natural Resources
Conservation Practice Standard

Vegetated infiltration swales are stormwater conveyance systems that differ from a conventional drainage channel or ditch in that they are constructed specifically to promote infiltration. Vegetated swales can also help attenuate peak flows through reducing runoff velocities and volumes.

Perkins Swale

- Criteria
  - Flow depth for WQv less than 3”
  - Hydraulic residence time >> 9 min
  - 8” of amended topsoil
  - Drain tiles to recapture field capacity
  - Infiltration capacity???
- Quantifying Volume
  - Monitoring
  - Modeling (ideal application of DrainMod)




Soil Water Characteristics by Texture
60
50
40
30
20
10
0
Wilting Point
Plant Available Water
Drainable Porosity
Sand
Loamy Sand
Sandy Loam
Loam
Silt Loam
Silty Clay Loam
Clay Loam
Clay

Soil Water Characteristics by Texture

Soil Texture	Clay Content	Wilting Point	Field Capacity	Plant Available Water	Field Capacity	Saturation	Drainable Porosity	Topsoil Saturated Hydraulic Conductivity	Subsurface Saturated Hydraulic Conductivity
	%	%	%	%	%	%	%	in/hr	in/hr
Sand	<5	5	9	4	9	46	37	4.5	2.8
Loamy Sand	6	6	12	6	12	46	34	3.6	2
Sandy Loam	10	8	18	10	18	45	27	2.0	0.8
Loam	18	13	27	14	27	46	19	1.7	0.2
Silt Loam	20	14	32	18	32	48	16	0.5	0.05
Silty Clay Loam	34	21	38	17	38	51	13	0.2	0.02
Clay Loam	34	21	35	14	35	47	12	0.2	0.02
Clay	>40	30	42	12	42	49	7	0.03	0

Note: Assume base density and 2.5% organic matter for all topsoil; 10% increase in density and 0.5% organic matter for subsoil

Source: Soil Water Characteristic Calculator (Saxton)

Swale Watershed Function Continuum

- Runoff Volume Reduction

- Water Quality Treatment

- Flow Attenuation/Peak Discharge Reduction

- Conveyance of a Specified Flow Rate
- Drainage

Monitoring Overview and Design Considerations

Monitoring Team

- Ryan Winston (NCSU) &
- Kevin Grieser (Biohabitats)

Stormwater BMP Monitoring: Lessons Learned

Ryan J. Winston
Biological and Agricultural Engineering
North Carolina State University

Presented at CRWP Collaborative Learning Group Meeting
Cleveland, Ohio
October 18, 2012

www.bae.ncsu.edu/stormwater

NC STATE UNIVERSITY
Bio&Ag ENGINEERING

Why Monitor Stormwater BMPs?

- Understand how design affects performance.
- Provide water budget for each BMP (infiltration, evapotranspiration, drainage, outflow, overflow).
- Determine effects of BMPs on larger catchments and watersheds.

- Increased velocity & quantity of stormwater runoff

- Heavily polluted by bacteria and PAHs (toxic organic substances resulting from combustion)

Monitoring Equipment

- Measuring Physical Parameters
  - Rainfall
  - Flow
    - Primary Devices
    - Secondary Devices
- Collecting Samples for Chemical Analysis
  - Grab Samplers
  - Automatic Samplers
- Water Quality Probes
  - Continuous measurements

Rain Gage Options

- Manual Gage
- Automatic
- Automatic w/ sampler

Manual Rainfall Gage

- Pros:
  - Reliable
  - Inexpensive
  - Fairly Accurate

- Cons:
  - Labor Intensive
  - Non-continuous
  - Susceptible to Evaporation
  - Invite “Public Assistance”

Automatic (Tipping Bucket) Rain Gage

- Pros:
  - Continuous Measurement
  - Low Labor Requirement
- Cons:
  - False sense of accuracy
  - Require calibration
  - Prone to failure due to wildlife deposits

General Guidelines on Rainfall Measurement

- Always have a back up
- Place gages away from nearby trees/power lines
- Provide for bird deterrents or alternate roosting options

Flow Measurement

- Primary Device: Structural device to constrict or otherwise control flow at a measurement point
- Secondary Device: Instrumentation used to determine flow or velocity based on measurements taken at Primary device

Primary Device

- Structural device used to allow the measurement of flow rate in an open conveyance
  - Weir
  - Flume
  - Orifice
  - Culvert
  - Channel

Primary Device

- Primary devices allow the determination of flow based on the measurement of the upstream head acting on the structure

Weirs

Pros:

- Accurate
- Simple to use
- Can be manufactured

Cons:

- High head requirement
- Clogging issues
- May act as a sediment trap
- May be expensive to construct

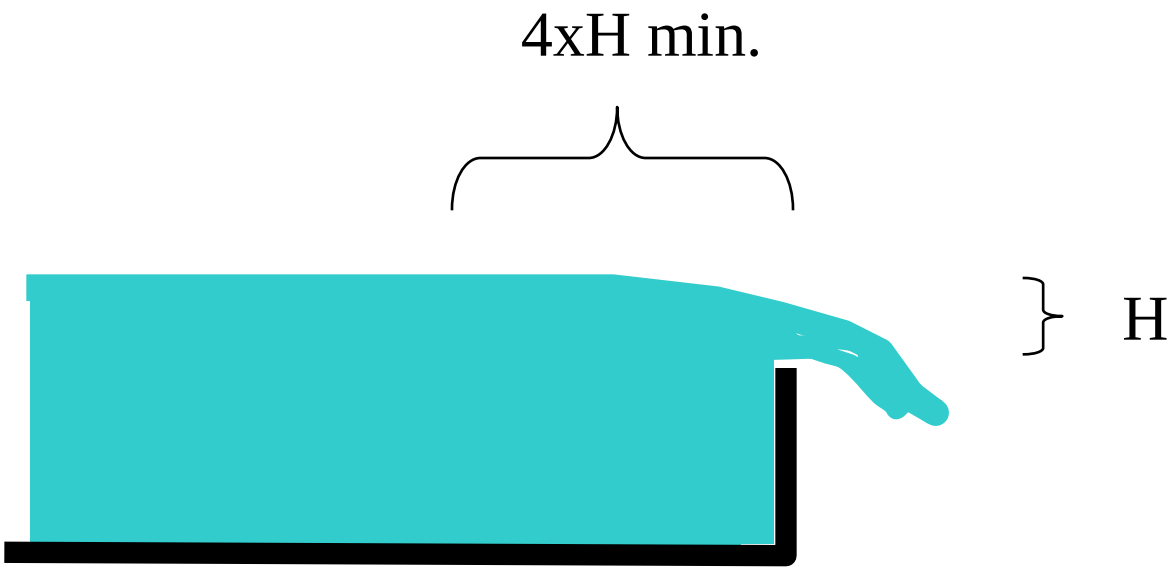
Primary Device: Weir

Weir Variations

- Rectangular:
  - low head requirement
- V-Notch:
  - wide range of flow measurement
- Compound

Compound Weir

Ideal Secondary Device (Sensor) Placement



Baffle
Weir

Installation Methods: Weirs

Flumes

Pros:

- Lower head requirement than weirs
- Fairly accurate
- Lower clogging concerns
- Level measurement only

Cons:

- Expensive (very)
- More complex than weirs/intricate discharge relationships
- Difficult to fabricate (Usually purchased from manufacturer)

Field Installed Flumes

Orifices (Orifice Plates)

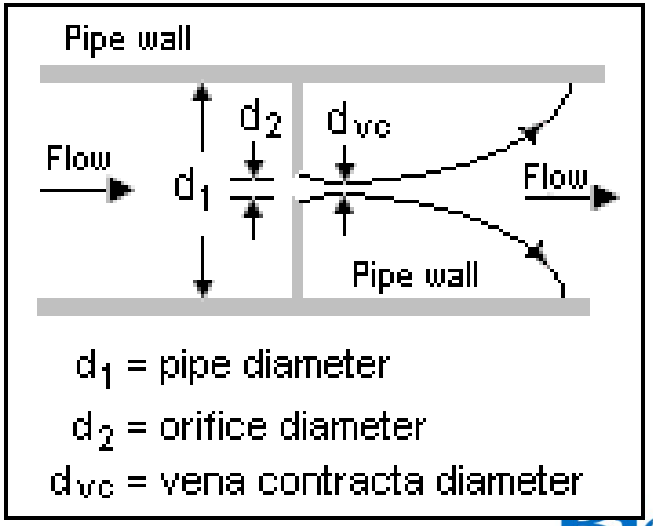
Orifice Plates

Pros

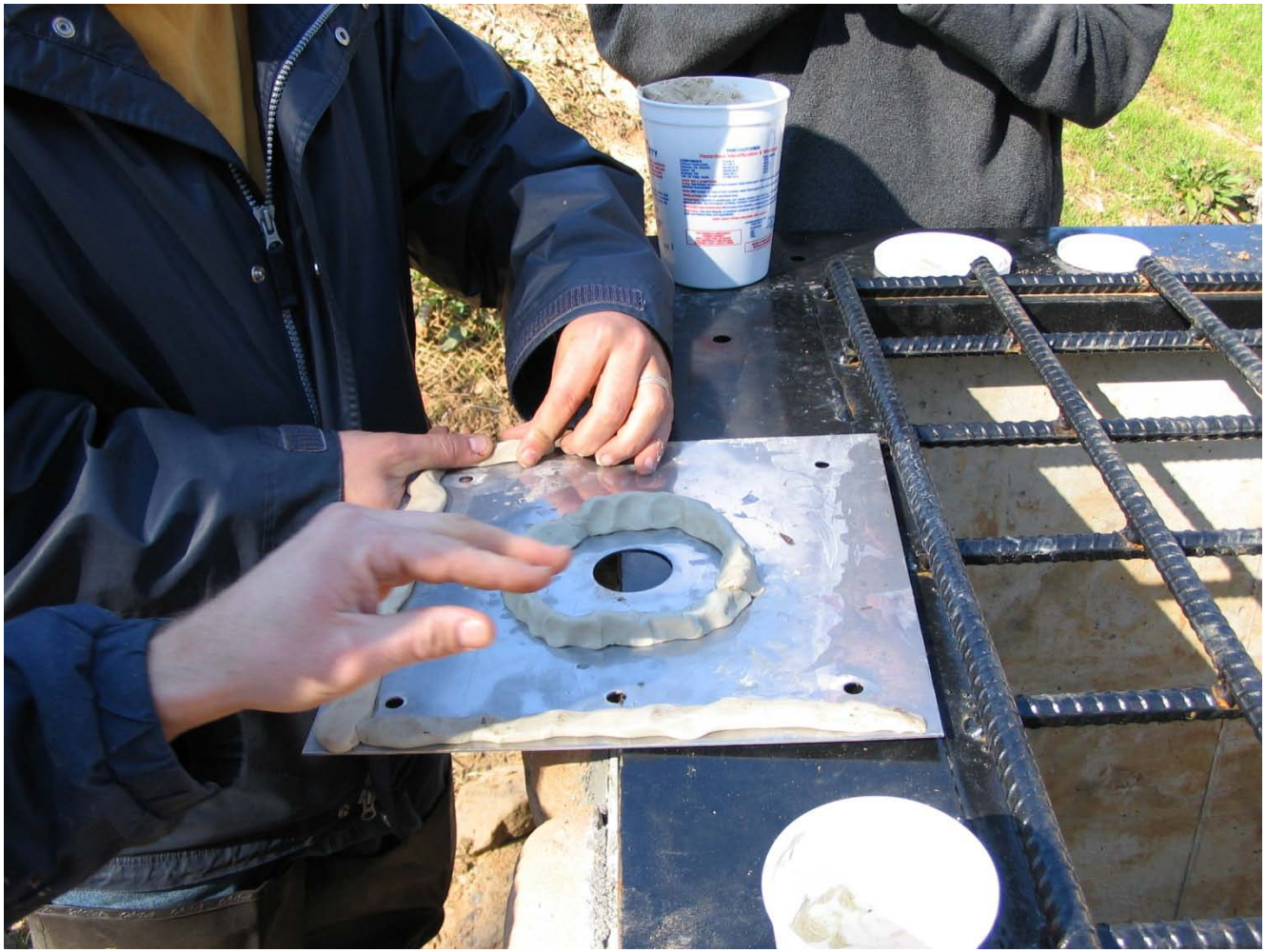
- Can be used for drawdown
- Fairly accurate
- Inexpensive
- Level measurement only

Cons

- Subject to clogging
- Require stage discharge relationship be determined



Orifice: requires “clean” edge



Culverts

- Pros:
  - Usually already in place
  - Unobtrusive
  - Inexpensive

- Cons:
  - Less accurate
  - Require measurement of level and velocity
  - Confined space entry?

MIGHTYEVAC

Monitoring in Culverts

Area-Velocity Measurements

Secondary Device

- Pulley Float
- Pressure Transducer
- Bubbler
- Sonar
- Area-Velocity Meter
- Rain Gage

Secondary Device: Pressure Transducer

- Uses a strain gage to determine the differential pressure at a sensor installed in the water column.

Secondary Device: Pressure Transducer

- Pros:
  - Accurate
  - Low power requirement
- Cons:
  - Cable susceptible to damage (turtles, beavers)
  - Sensitive to temperature extremes

Secondary Device: Bubbler

- Measures the resistance acting on an air bubble introduced into a water column.
- Water level causes resistance (pressure) on the air bubble.

Secondary Device: Bubbler

- Pros:
  - Non contact
  - Fairly accurate
  - Tolerates environmental extremes
  - Rodent “hardy”
  - Inexpensive to repair if damaged
- Cons:
  - High power requirement

Secondary Device : Area-Velocity Meter

- Measures the velocity and level of a column of water flowing over a sensor using Doppler shift effect. Requires a known cross section or conduit.

Secondary Device: Area-Velocity Meter

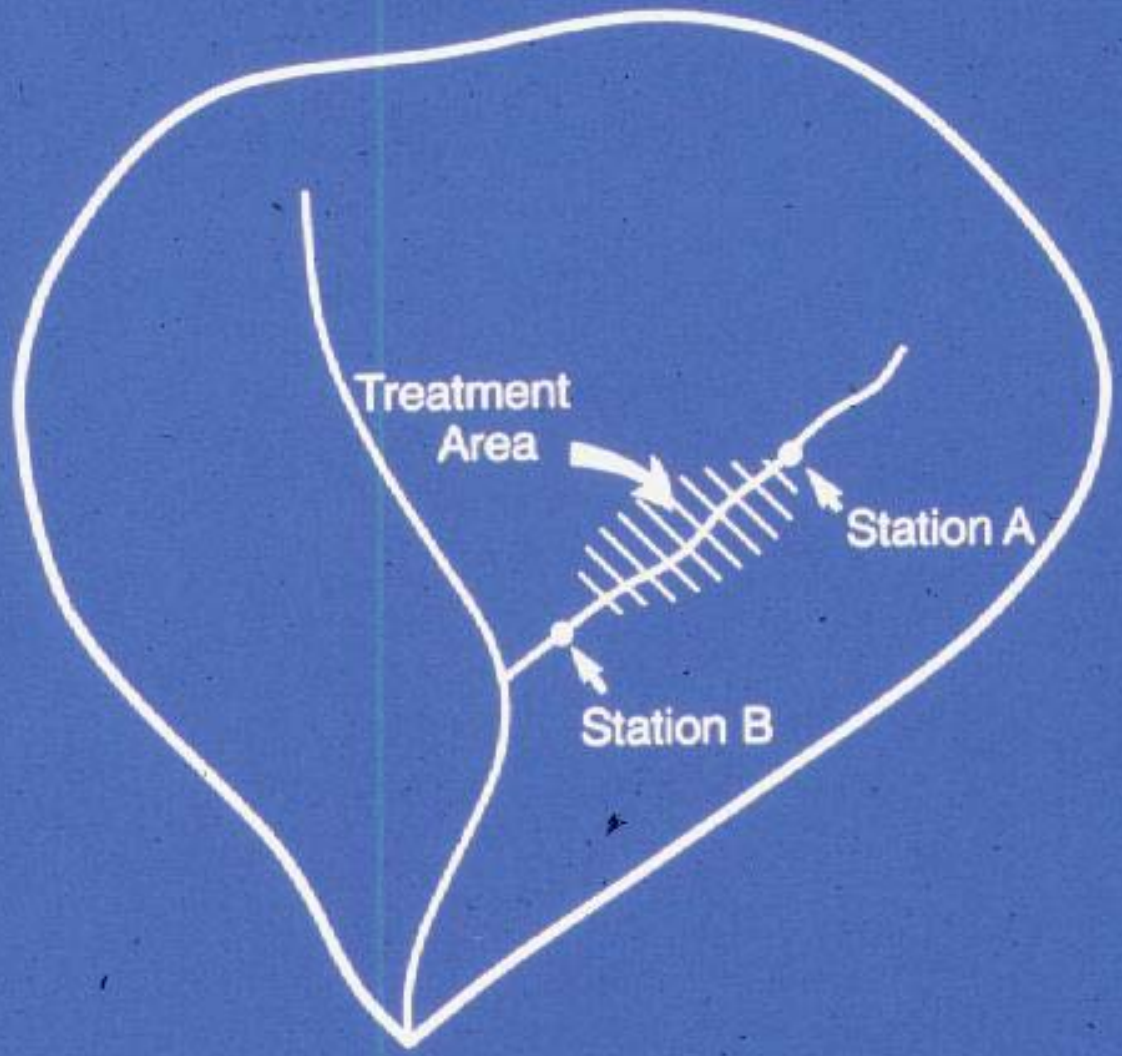
Secondary Device: Area-Velocity Meter

- Pros:
  - Can be used in tail water
  - Can measure both positive and negative flow
- Cons:
  - Low accuracy
  - High power requirement
  - Susceptible to environmental extremes
  - Susceptible to film forming on sensor face
  - Also damaged by turtles and beavers

Location of Sensors and Intakes

- Secondary device
  - Depends on primary device type
- Sample intake:
  - Well mixed location
  - Representative of total flow
  - Mid point of flow

Upstream/Downstream and Pre- and Post- BMP Design

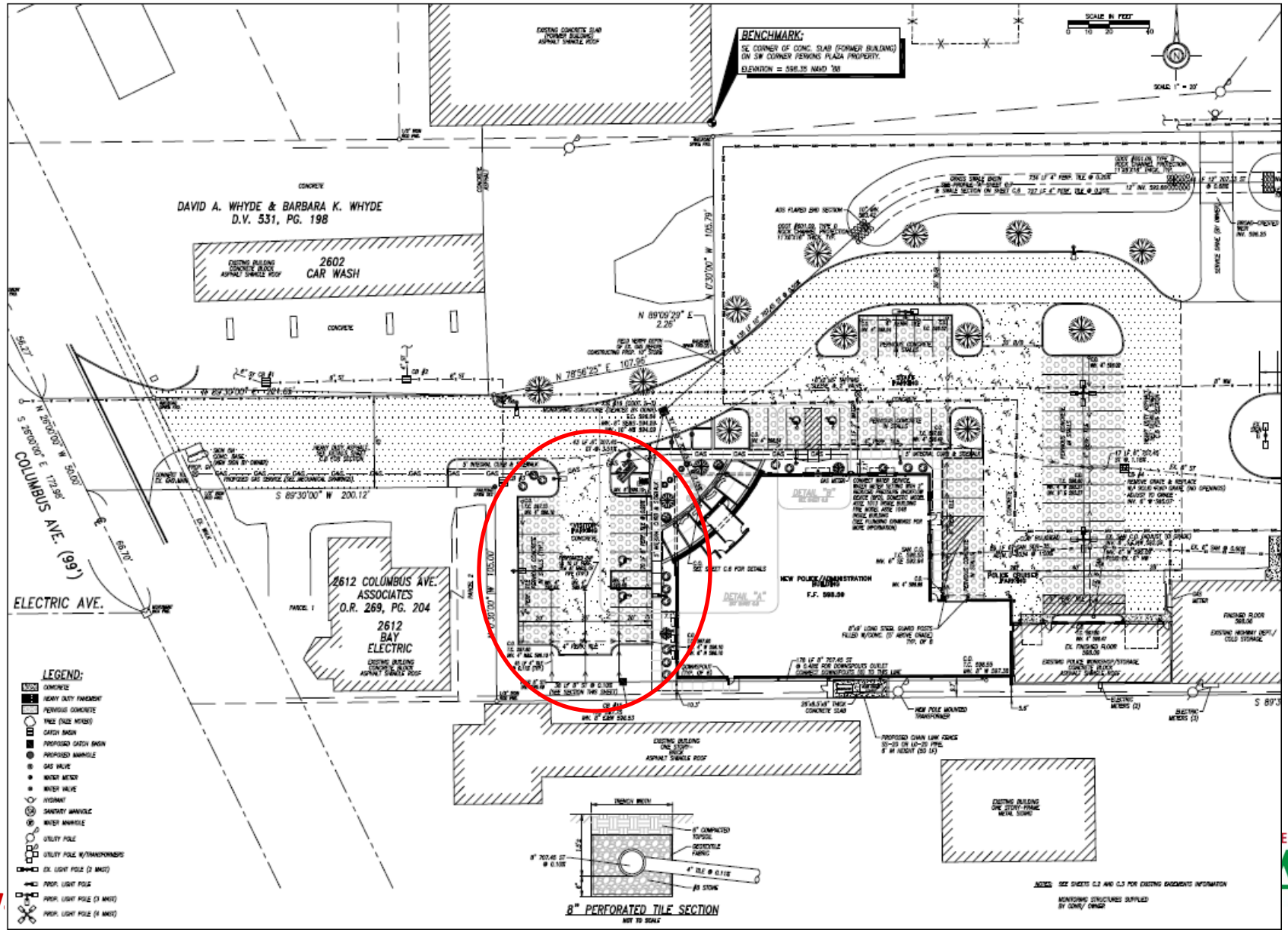


Upstream/Downstream Experimental Design

Upstream/Downstream Design

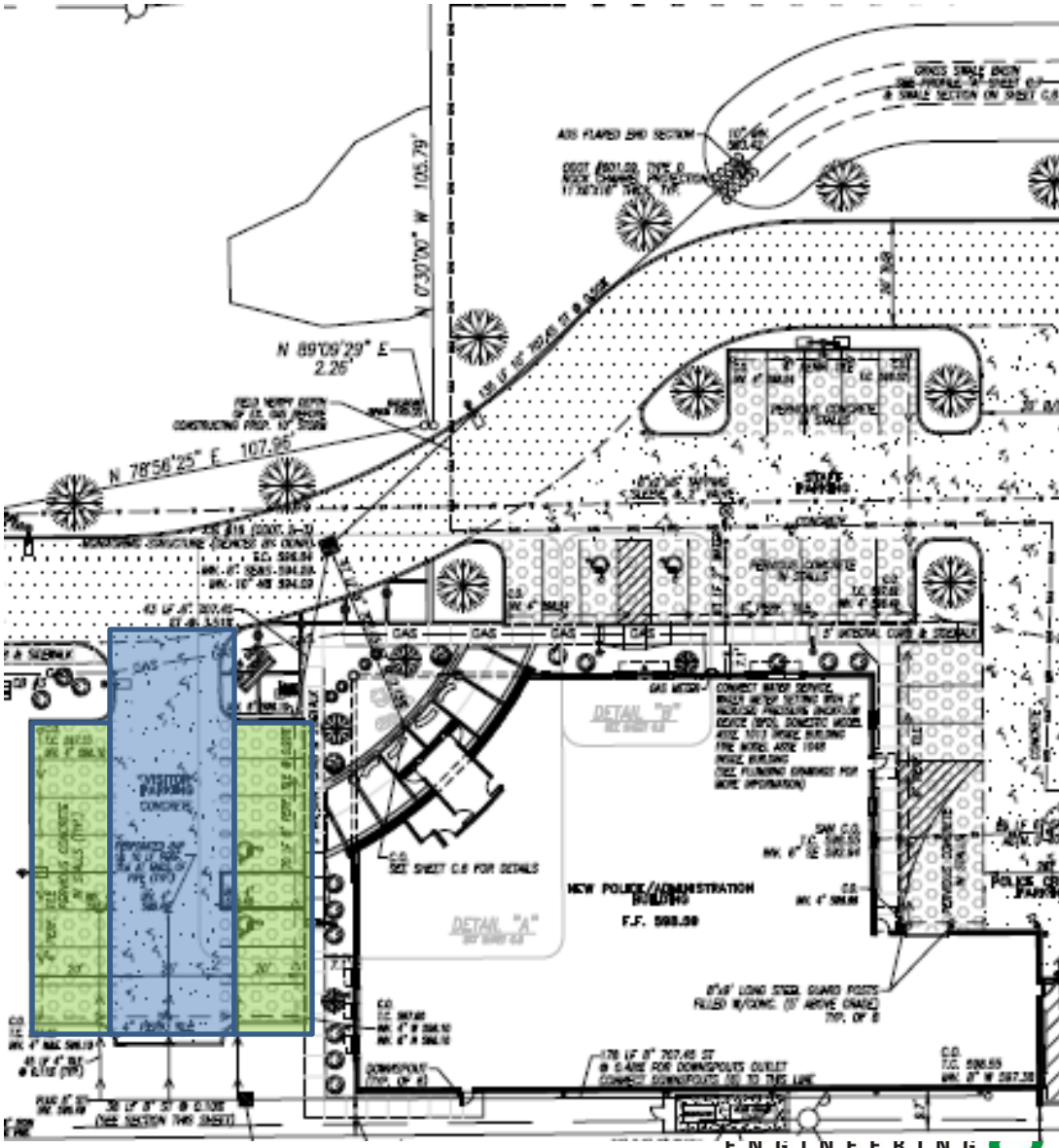
- Most Stormwater BMPs
  - Wetponds
  - Wetlands
  - Bioretention
  - Proprietary devices

Case Study: Perkins Township

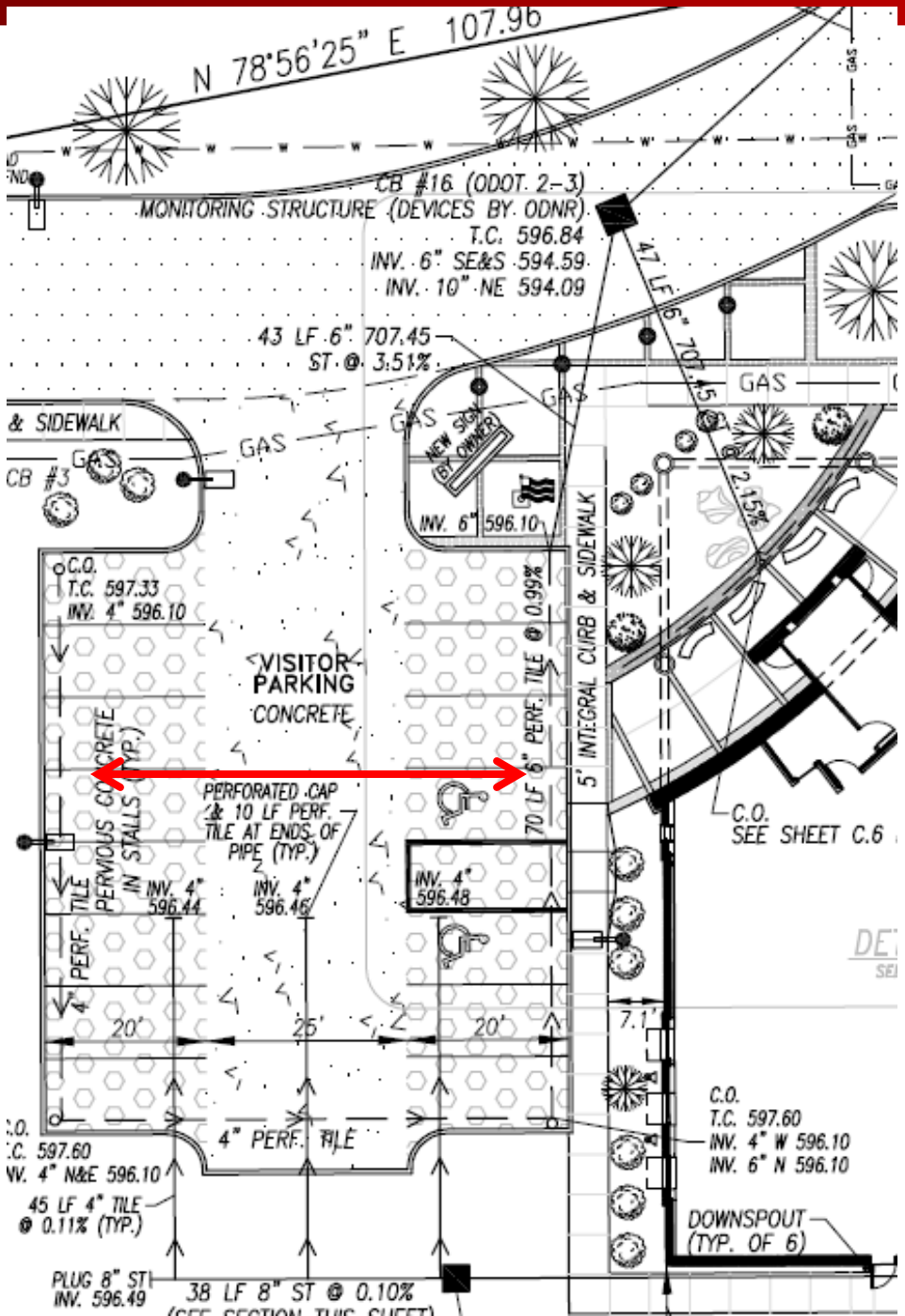


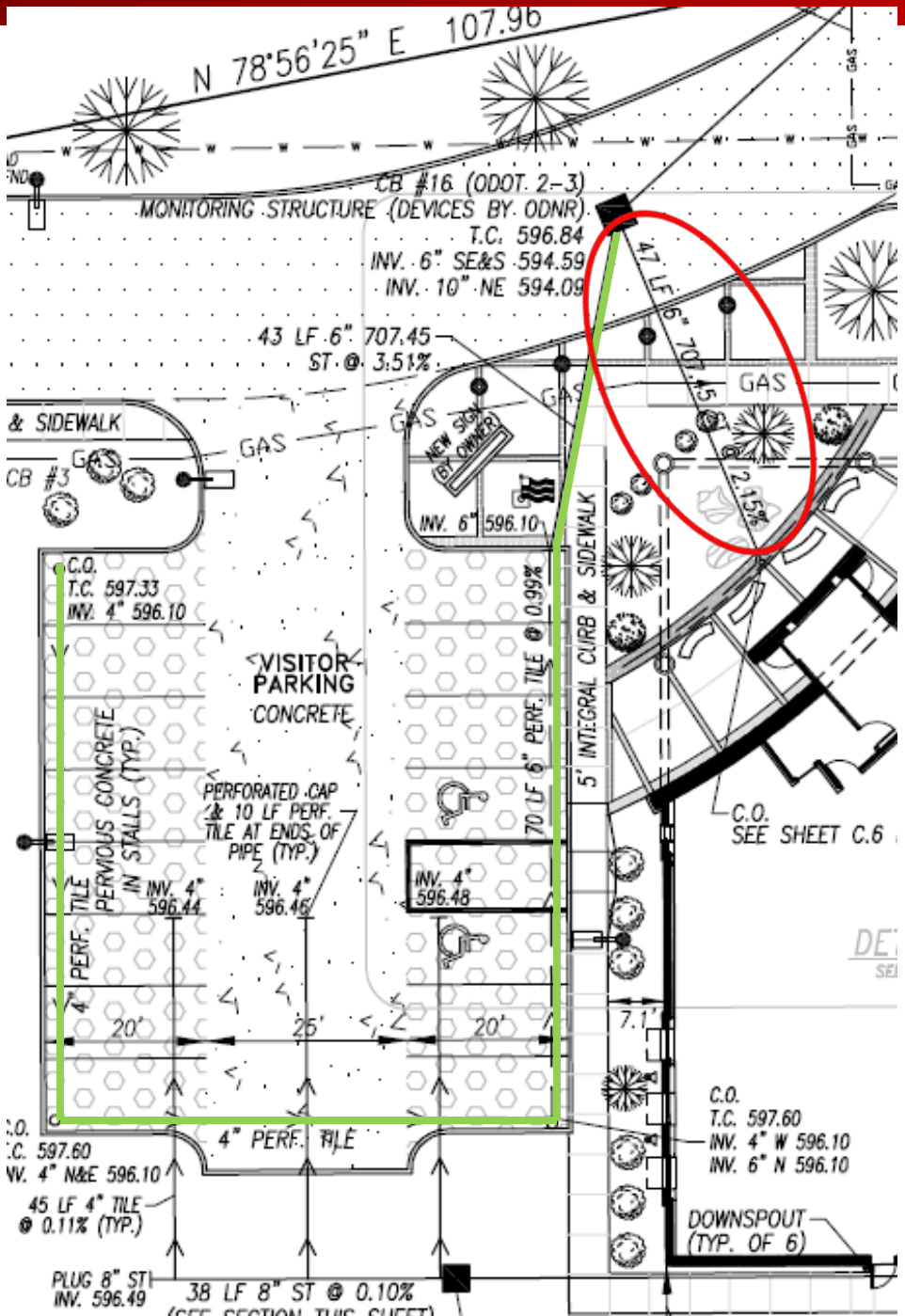
Permeable Pavement Monitoring

- Standard Concrete Drive Lane
- Permeable Concrete Parking Stalls
- Inflow Monitoring?



Inflow Monitoring (Diffuse Flow)





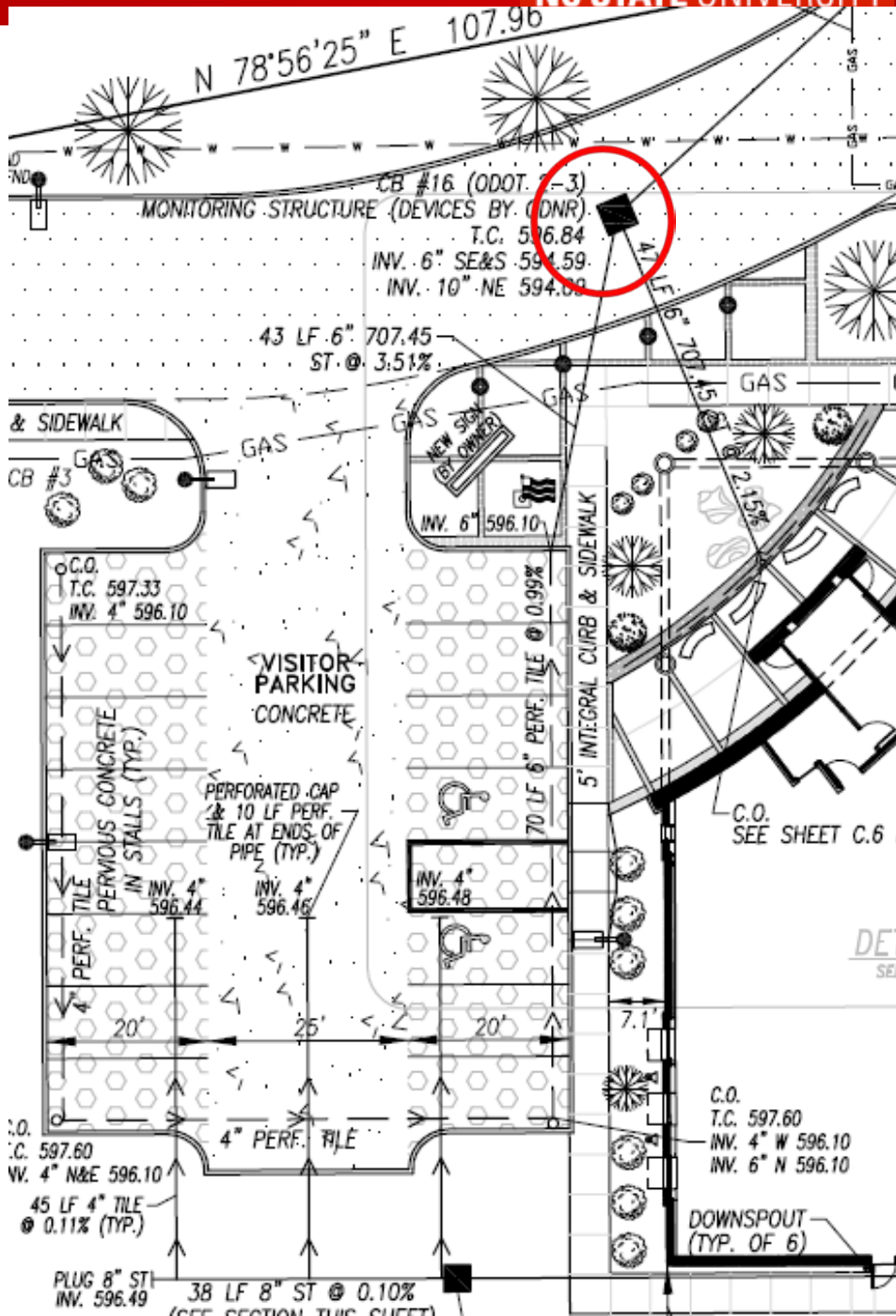
Outflow Monitoring

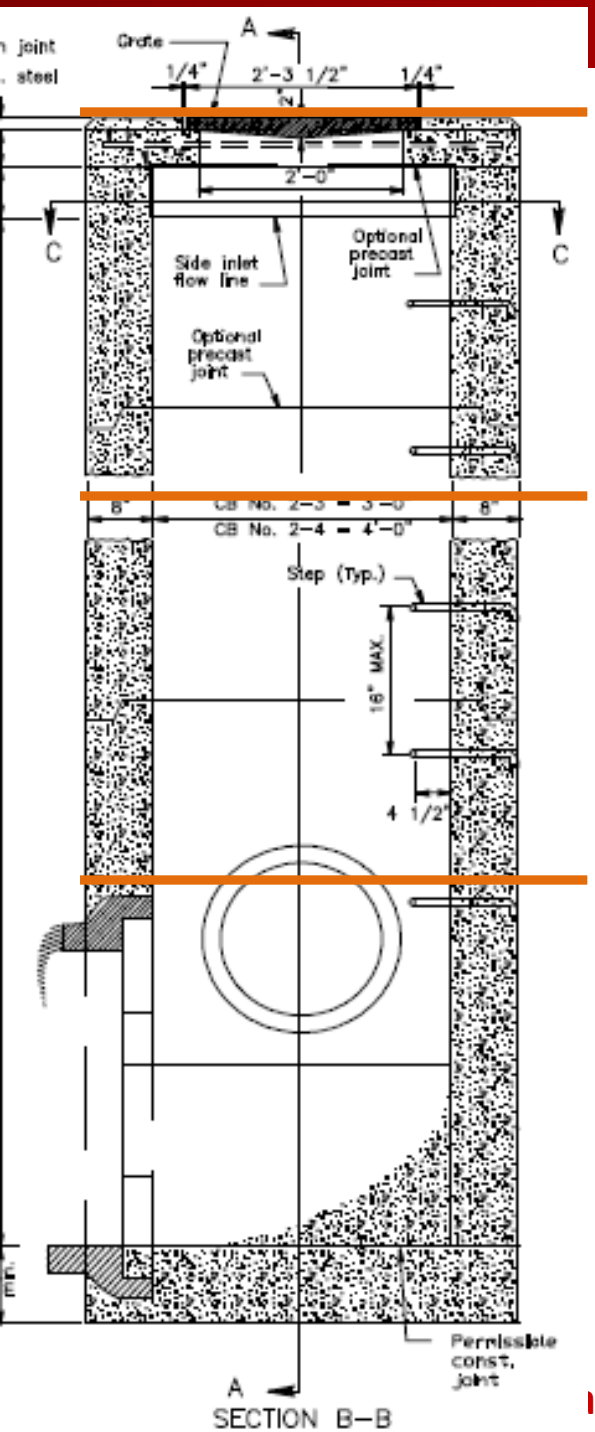
- 6” underdrain to junction box
- Pipe diameter too small for area-velocity
- Use weir (v-notch gives best low-flow accuracy)
- Second pipe has potential to confound measurement during high flow

NC STATE UNIVERSITY Bio&Ag ENGINEERING

Location of Junction Box

- What is the challenge or issue with this choice of location?
- Always put junction boxes in accessible location (preferably in a grassed/planted area) for safety and ease of equipment installation

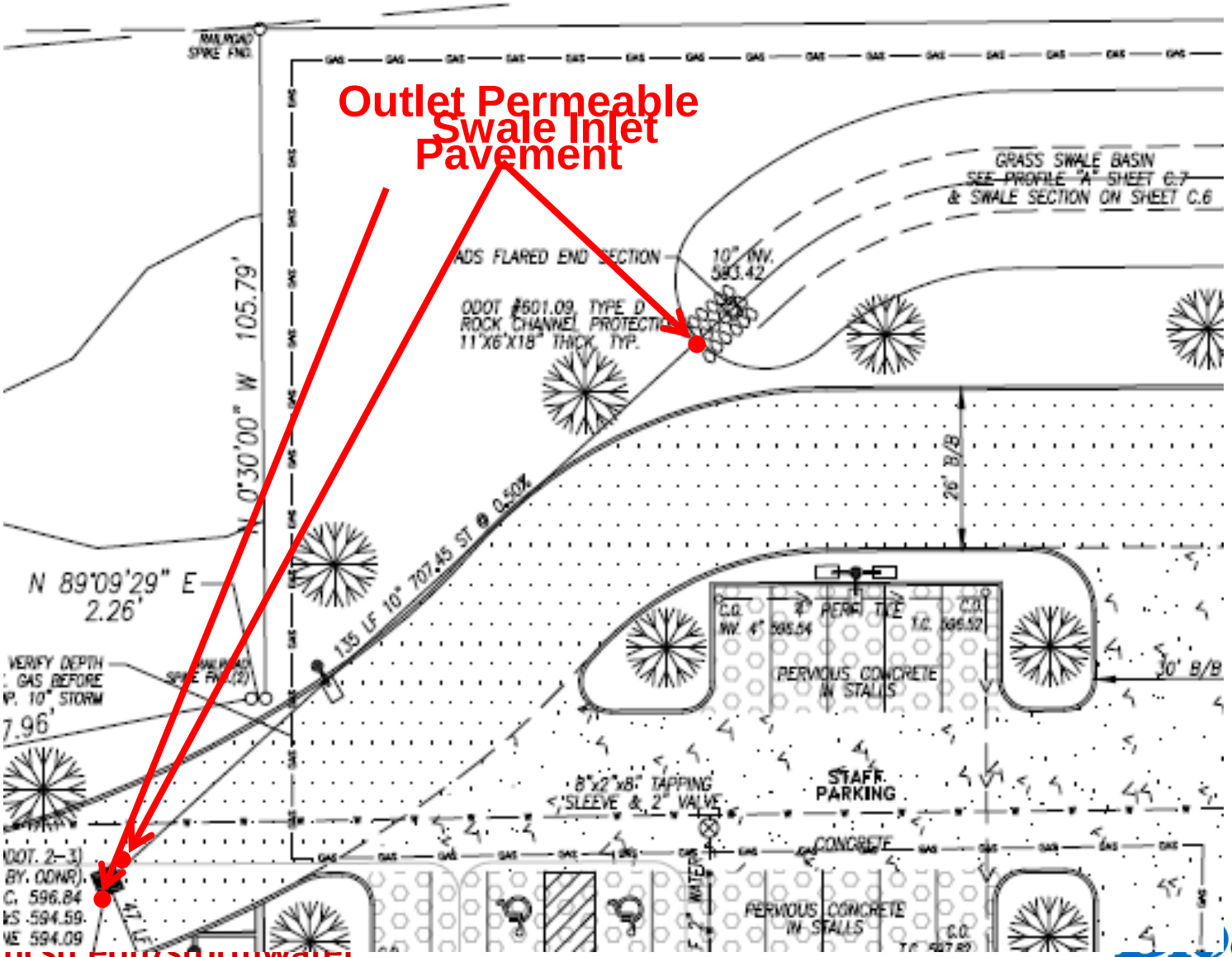




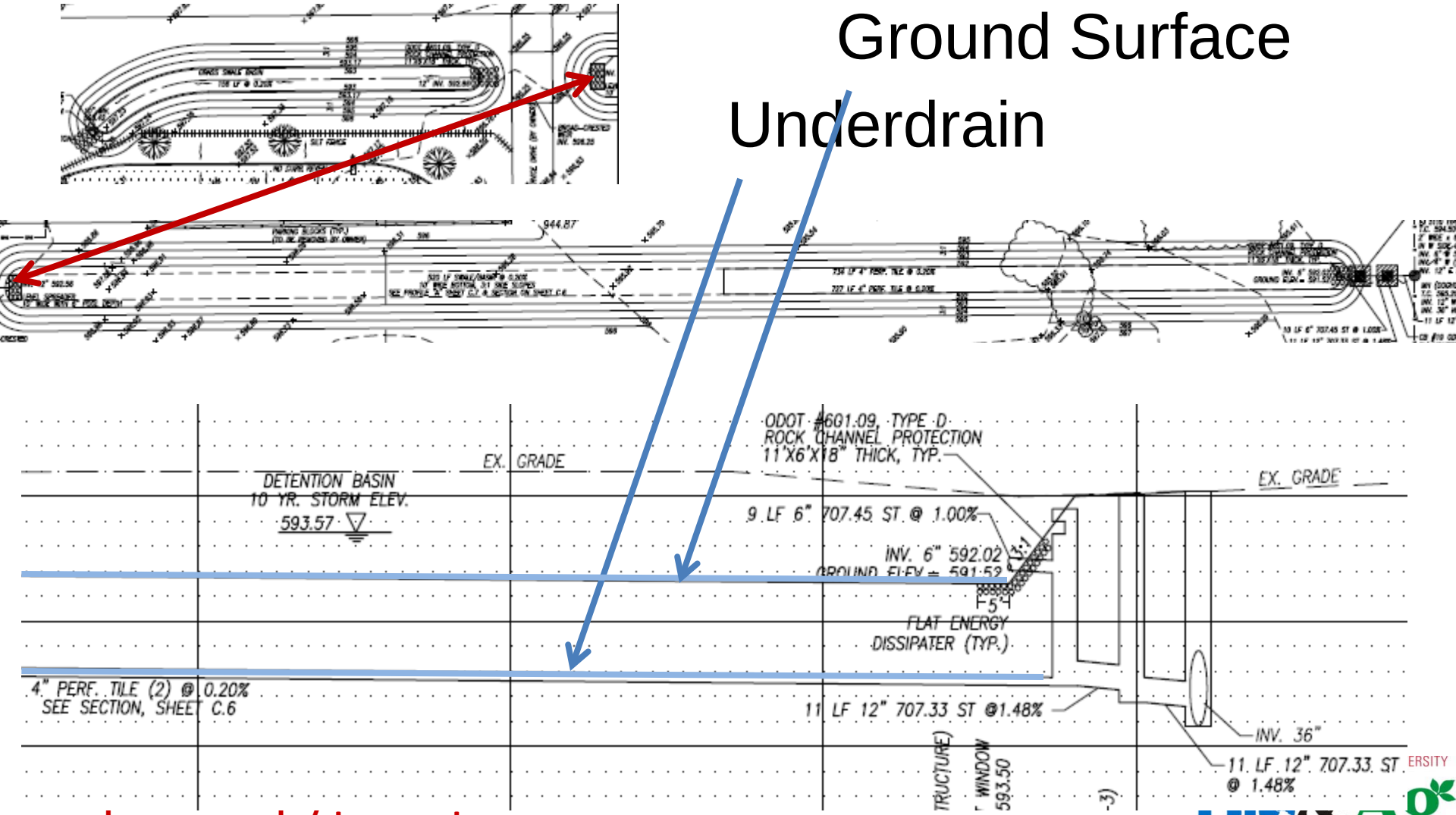
Junction Box Monitoring

- T.C. = 596.84 ft
- INV 6” UD and 6” pipe
  = 595.10 ft
- INV 10” Outlet
  = 594.09 ft

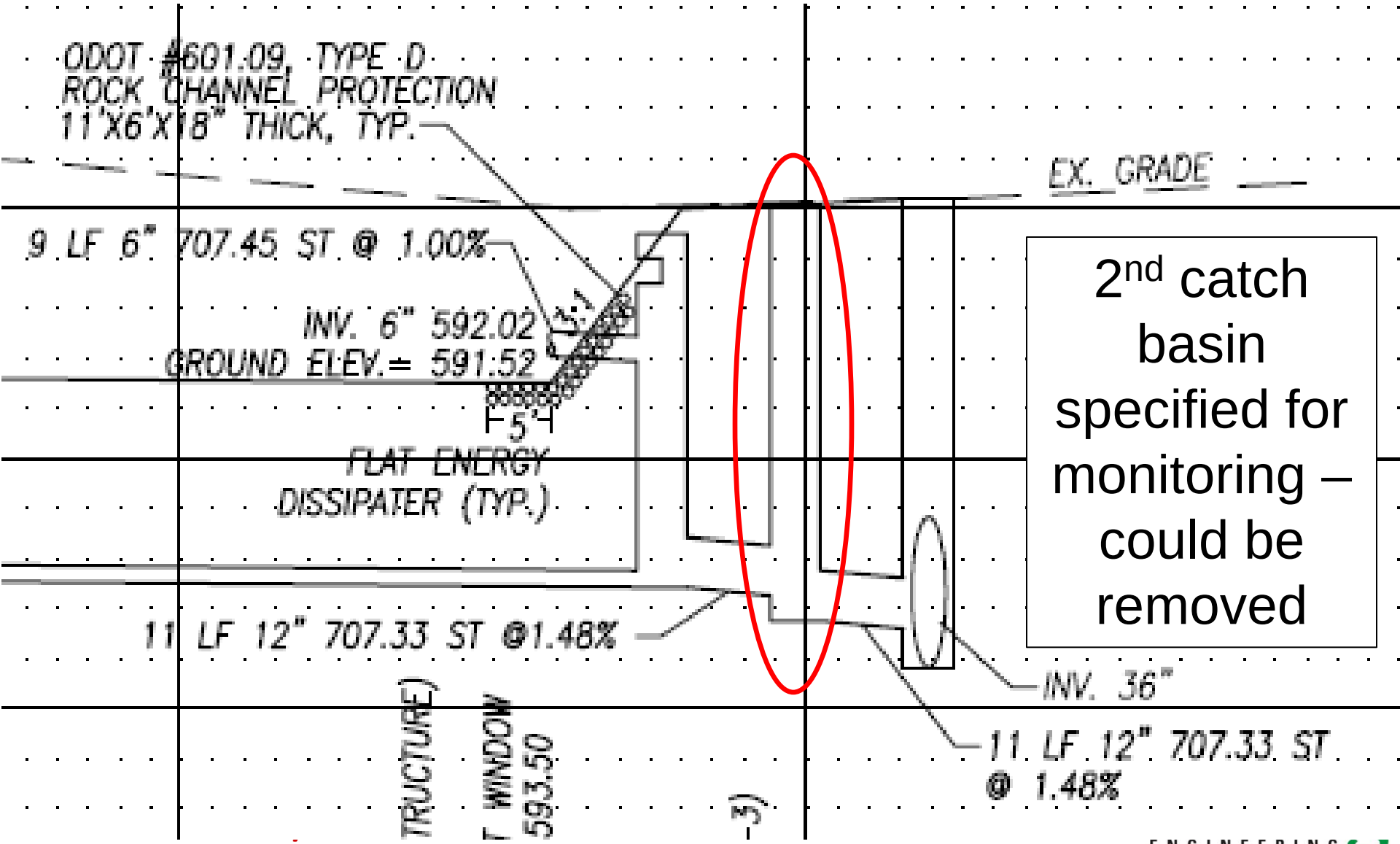
Weir Locations



Swale Outlet Monitoring

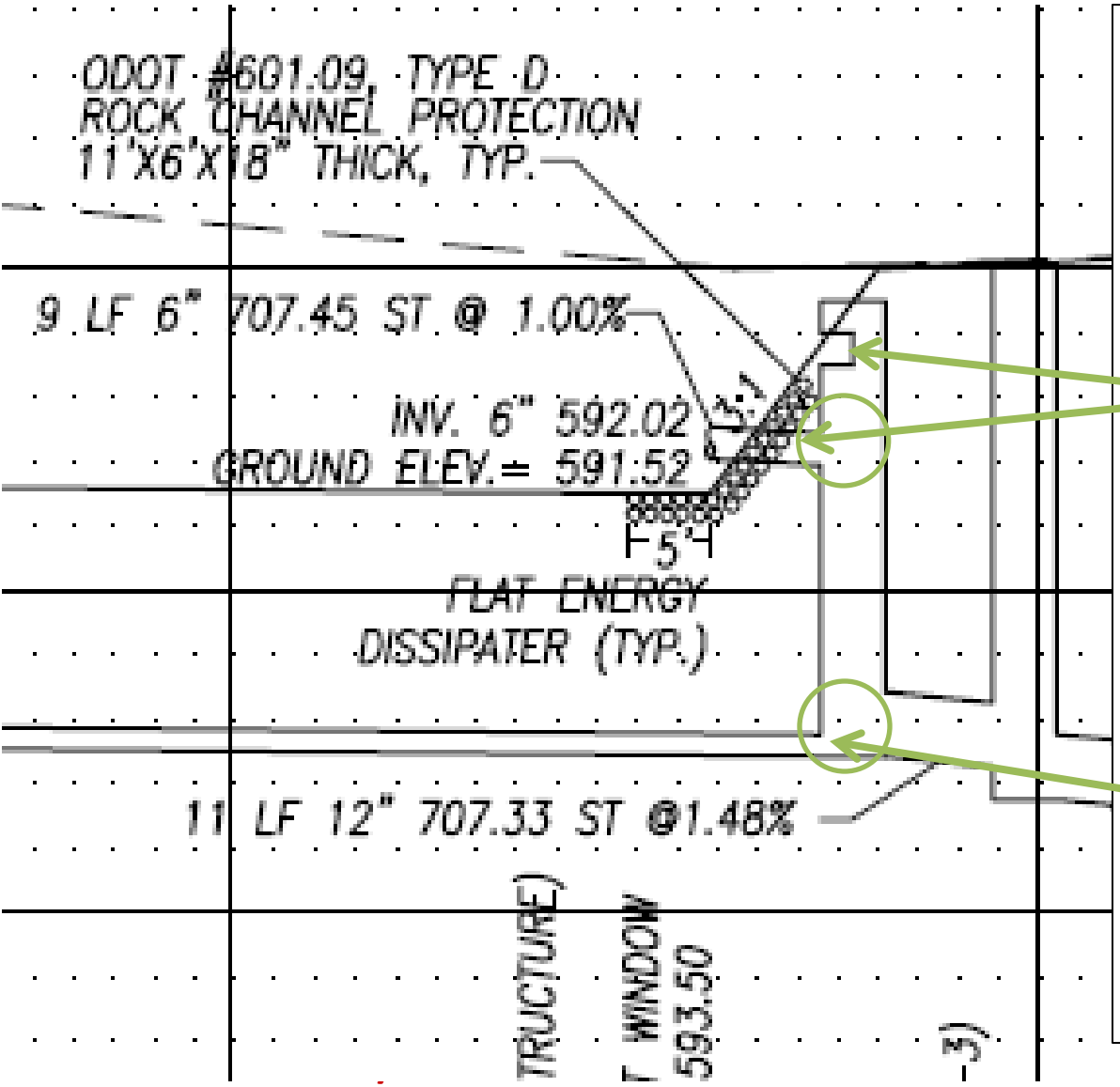


Swale Outlet Monitoring



2nd catch basin specified for monitoring – could be removed

Swale Outlet Monitoring



- Use two weir boxes for monitoring
- Measure flow from 6” orifice and 2’ X 6” broad crested weir
- Measure drainage separately from underdrains

Questions?

Design Assistance Updates

1. Old Woman Creek NERR (site visit)
2. Perkins Township Administration Building
3. Willoughby Hills Community Center
4. Orange Village Service Facility
5. Pepper Pike City Hall

Perkins Township

Pre-Construction

Alternative Solutions

- Recycled materials
- Milling
- Asphalt verses Concrete

Perkins Status

- Currently under construction:

Things to Consider:

Funding

Timing

Weather

Space

Design

Monitoring

Existing Conditions

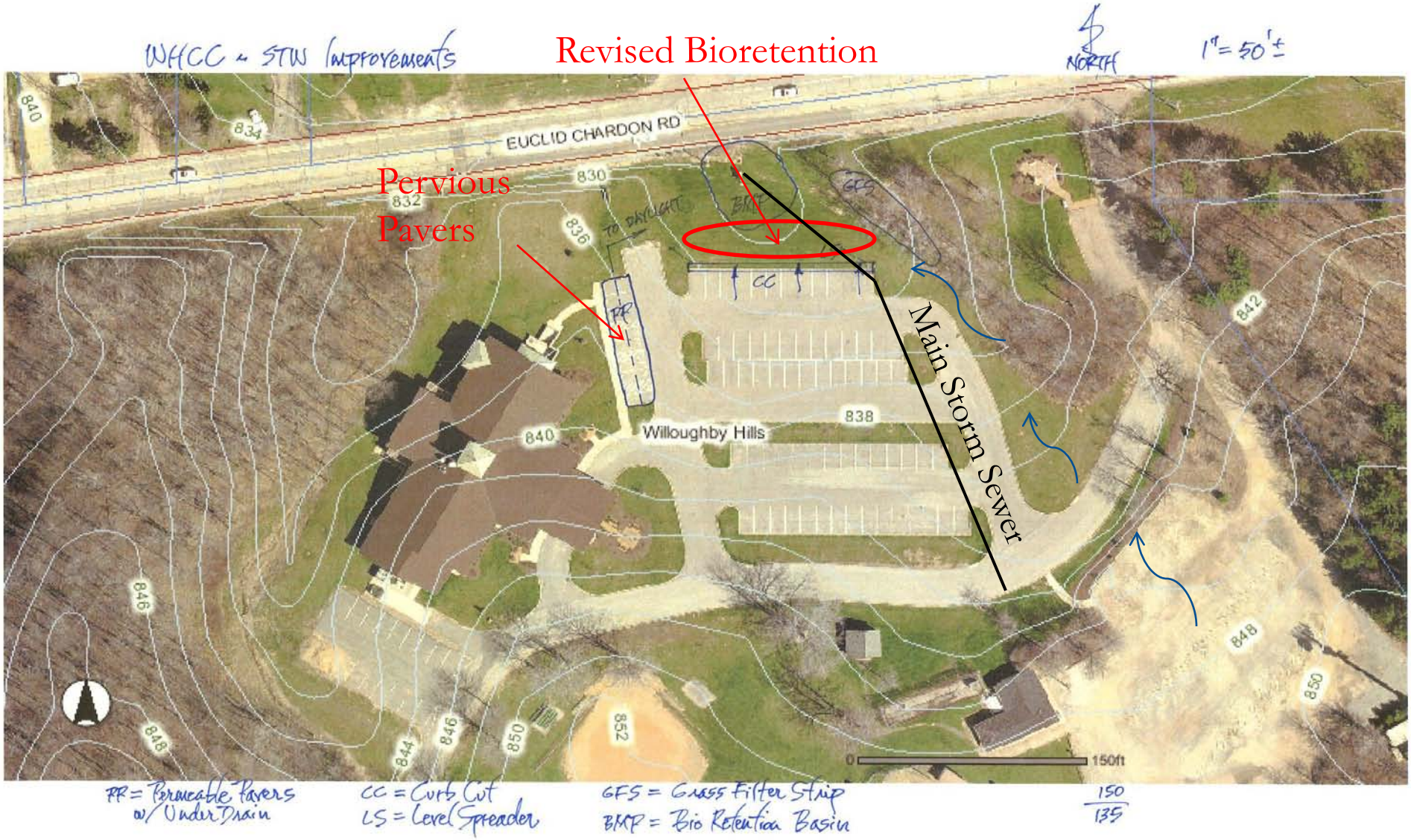
Drainage

Local & Phase II Requirements

Building A Successful Project:

- **Getting the right people at the table**
- **Understand limitations:** Space, Budget, Environmental Concerns, Local Regulations (Zoning/Storm Water), State Regulations (OEPA), Timeframes, Barriers
- **Partnerships Created:** Local, Government, County, Businesses
- **Knowledge of Opportunities:** Grants, Design Assistance

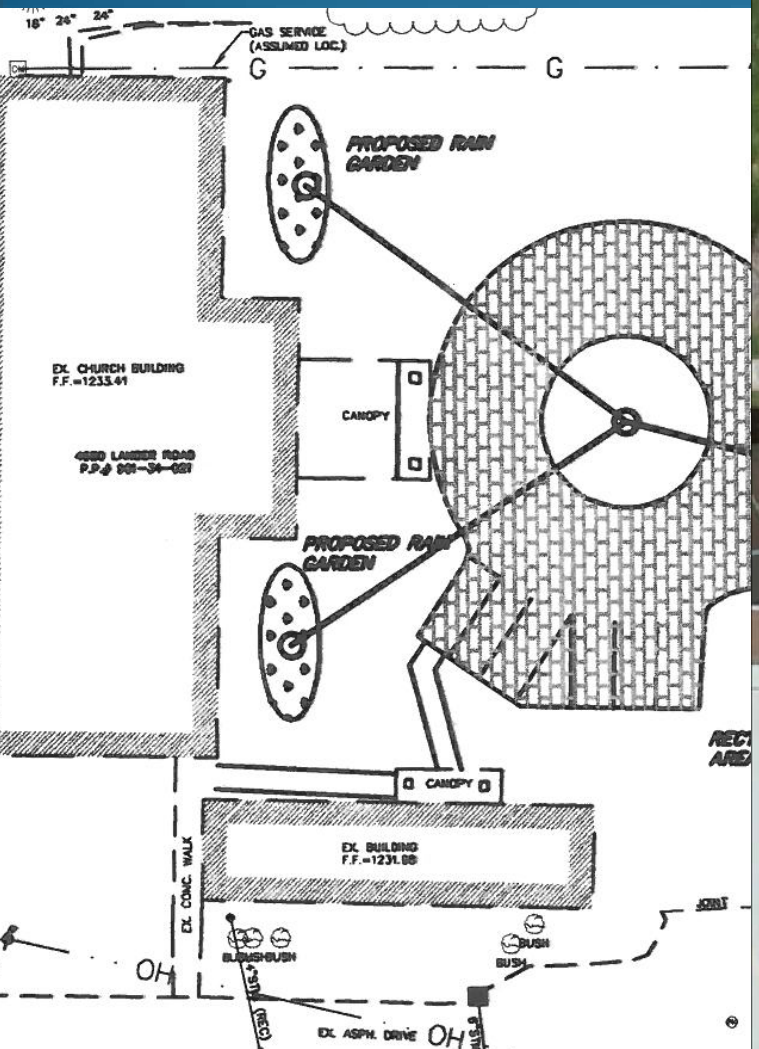
Willoughby Hills Comm. Ctr.

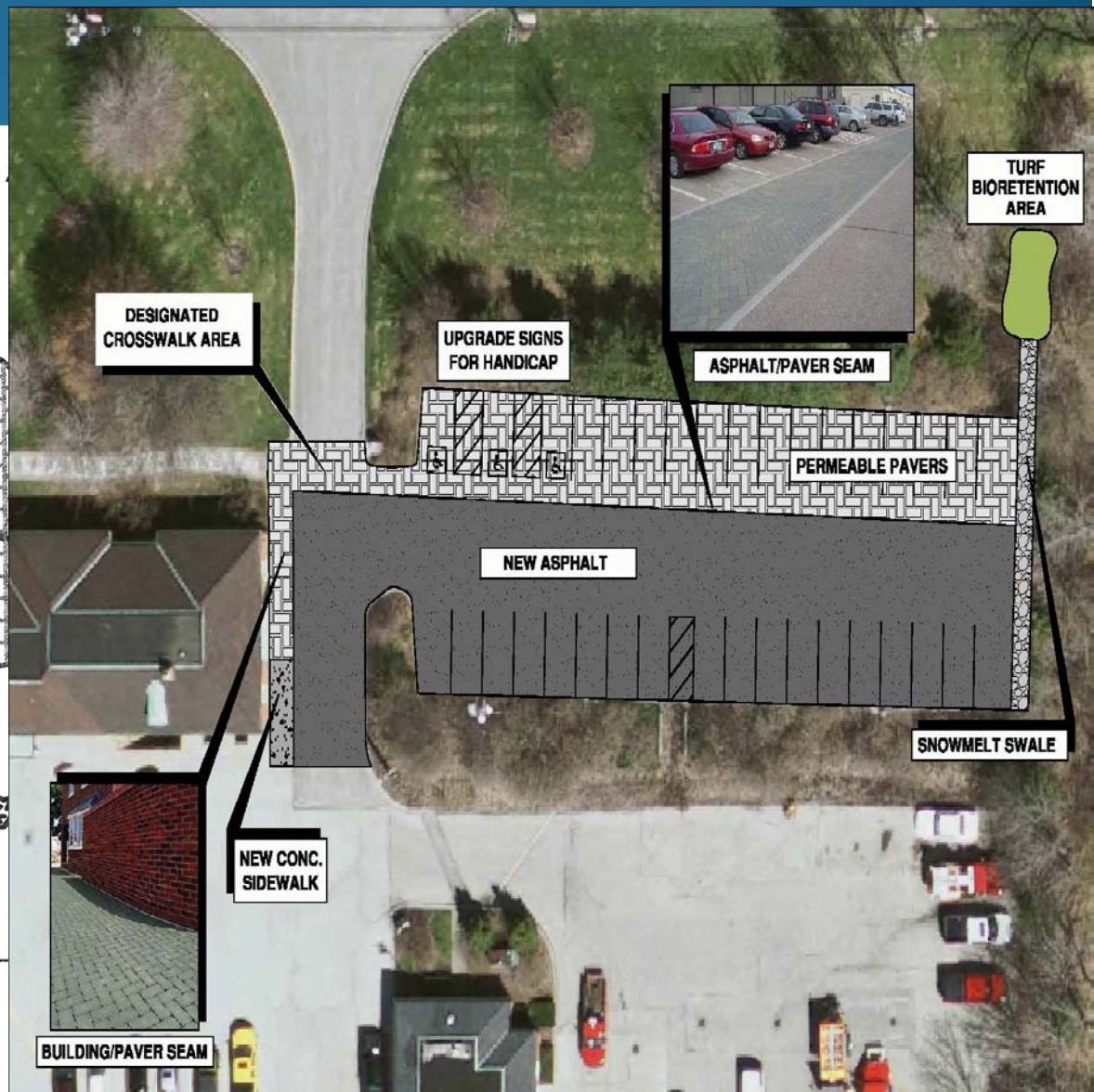


Willoughby Hills Community Center

- City completed SWIF grant agreement with Ohio EPA to install pervious pavers and bioretention
- Contract for site design between the City /CT Consultants and CRWP under review with approval anticipated by November 1st
- Project kick-off meeting held October 4th
  - Collaborating partners expectations aligned and in agreement to move forward with design
  - Conceptual BMP locations revised
- Next Steps:
  1. As-built field survey data collection
  2. Infiltration testing
  3. Detailed conceptual design development
  4. Review by PT, CLG, NCSU & Ohio EPA

Orange Village and Pepper Pike





Lessons learned - Infiltration testing

- Design discussions based on infiltration test results
  - Perkins
  - Old Woman Creek
  - City of Sandusky Warren Street Brownfield Redevelopment
    - ODNR – DSWR conducted infiltration test and soil investigation to inform plans for potential bioretention
      - Results – backhoe hit bedrock at 2 foot depth in first pit
      - Barriers identified thru infiltration test
    - ODNR available for infiltration testing and soil investigation for sites associated with this project

Break

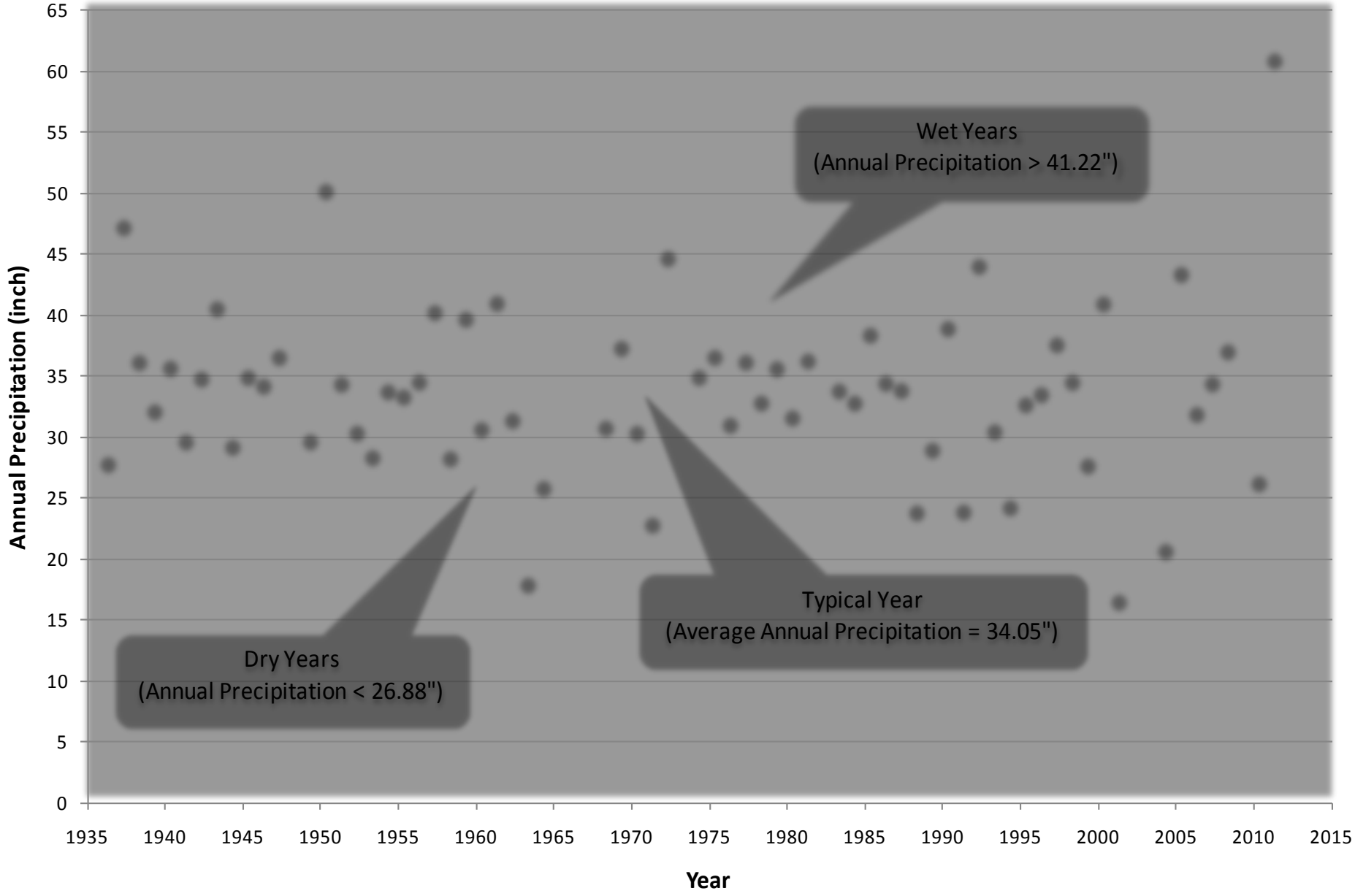
Working Lunch

1. Modeling updates
2. Other monitoring work
3. Training and outreach
4. Survey results
5. 2013 meeting dates

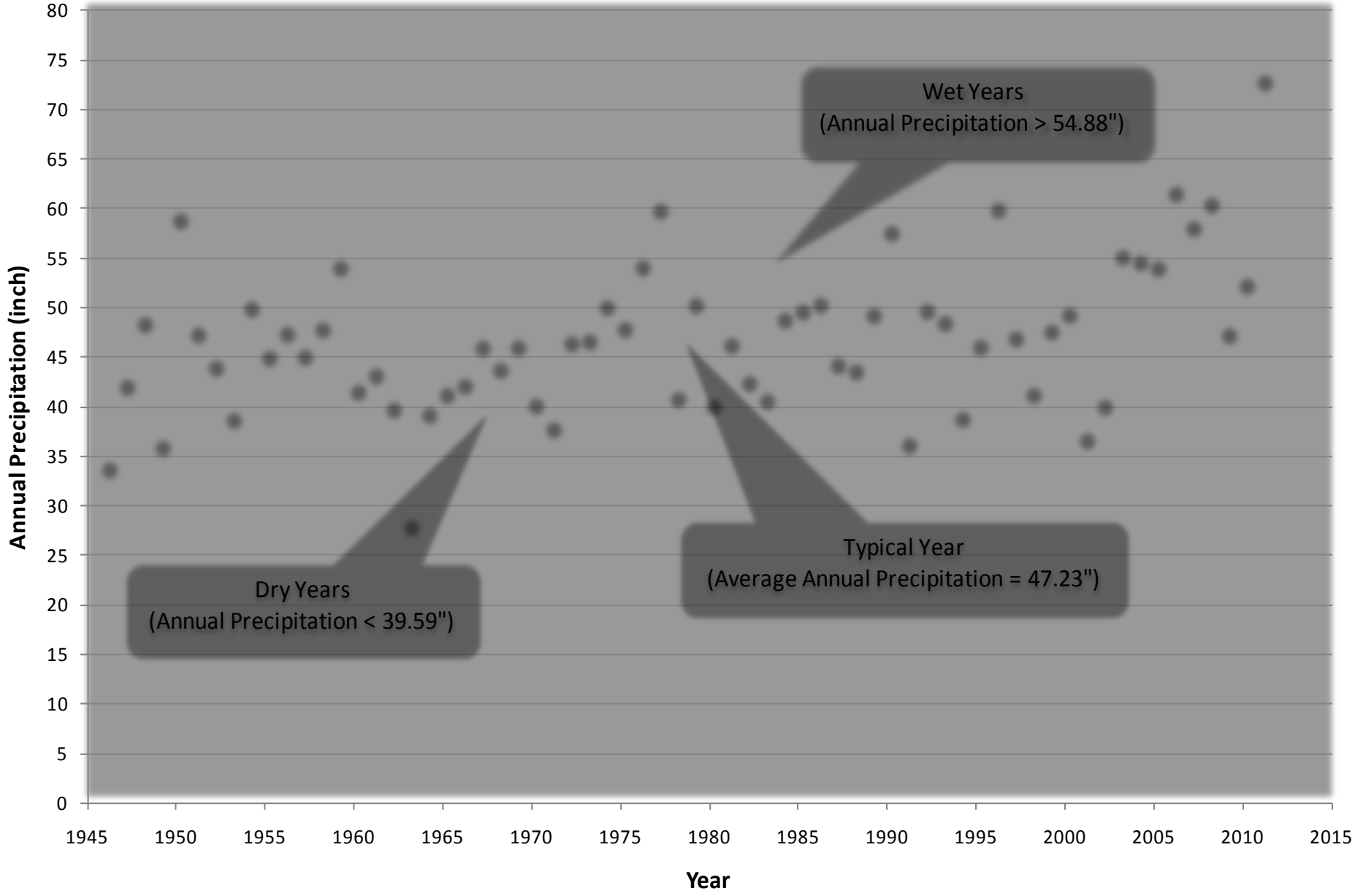
Modeling Update

- Progress
  - Analyzed historic climate data needed to run models for project focus areas
  - Comparison of Atlas 14, Bulletin 71 and TP 40 data for project focus areas
  - Developed continuous and design event data sets based on historic record including analysis of typical, dry, and wet years
  - Researched availability of evapotranspiration data
- Contract changes

Sandusky, Ohio
Wet/Typical/Dry Years Based on Annual Precipitation



Chardon, Ohio
Wet/Typical/Dry Years Based on Annual Precipitation



Fact Sheet: *Considerations for Making Stormwater BMPs Monitoring Capable*

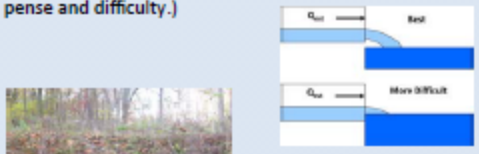
Stormwater BMP Monitoring Considerations

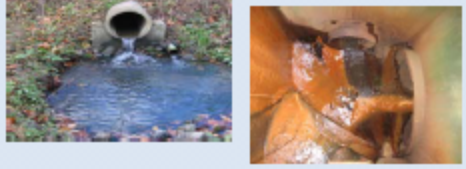
1. Outflow (Outlets)

Flow can be measured in a pipe or a channel section.

A single outlet point minimizes problems and costs.

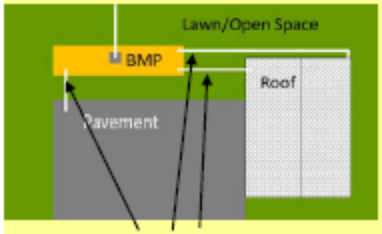
Whether or not the monitored outlet is in a catch basin, free overfall is preferred (backwater conditions add expense and difficulty.)





2. Inflow

Inflow to a BMP can be characterized through measurement and/or modeling.



Measurement - Each inflow point requires its own flow measuring equipment; consider directing inflow through a single pathway to facilitate monitoring.

Impervious areas are easier to model

Modeling - The entire drainage area must be delineated and well characterized for accurate hydrologic modeling.

Pervious areas increase uncertainty

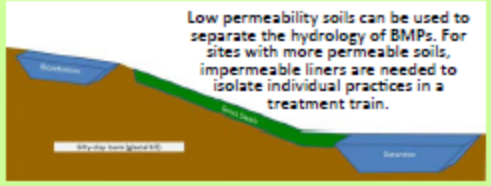
3. Design and As-built Documentation

Provide a thorough and accurate description of the site and practice as designed and as built, including:

- What requirements or design parameters were used to size the system?
- Are as-built dimensions and quantities accurately documented? "Typicals" are inadequate to describe system.

4. Separation and Integrity of BMPs

BMPs in series can be challenging to monitor. Does the layout of the practices allow isolating the hydrology of each for monitoring purposes? This requires clearly defined inflows and outflows, and eliminating subsurface connections.



Consider whether the situation of each BMP lends to isolating the hydrology of each practice for monitoring purposes.

We are attempting to increase the understanding of how innovative stormwater BMPs perform under Ohio's soil and climatic conditions.

Contact Jay Dorsey or John Mathews for more information on assistance with monitoring your BMP. (614-265-6610 or DSWR@DNR.state.oh.us).

Training and outreach

- Stormwater codes workshop
- BMP workshop & CESSWI course w/ Perkins site visit
- Coastal States Organization
- EcoSummit Conference
- J. Ruvolo, Congresswoman Marcy Kaptur
- NOAA – NOS Asst Administrator David Kennedy
- Chagrin River Watershed Partners Board Meetings
- Coastal Resource Advisory Council
- Erie County Township Assoc. and SWCD Annual Banquet
- Erie County Clean Water Coalition

Technical Assistance: CRWP

- Solon: Erosion and Sediment Control and Stormwater Management updates at Public Works Committee
- Solon: Site plan review and conflicts between compensatory storage for floodplain fill and stormwater management
- Mentor and Orange: Model language to update Off Street Parking Code
- Coordination with Cuyahoga County Board of Health, SWCDs, Ohio EPA, ODNR, NEORSD on Inspection and Maintenance Checklists/Manual
  - Research on I&M for Pervious Pavements and Bioretention
- Better Site Design Tour/Workshop

Technical Assistance: Erie SWCD

- Kirby Date, Ohio Balanced Growth Program - ordinance & zoning compliance measures with alternative solutions for communities
- Clean Water Coalition –coordination with regulated communities for compliance updates, local innovative techniques and providing resources/tools for implementation
- Illicit Discharge Detection & Elimination - technology based strategies and partnering with local agencies to maximum efficiency and program success
- Building and sustaining partnerships throughout county communities and local agencies
- Coordinating efforts for an updated Stormwater Management Plan to reflect community needs and values

Your Feedback

- 11 of 14 – "participating is a good use of my time"
- 9 of 13 have shared information with others
- 10 of 13 using information in work or decision-making
- 31% encountered obstacles to implementation
- 1 of 11 have changed design or management approach based on project experience. Almost all others said research not yet far enough along

Fall and Winter Workplan

- Complete stormwater design for four funded projects
  - CLG/monitoring site visits and webinars
- Instrument 2 projects for monitoring
- Begin building models
  - SWMM
  - DRAINMOD
- Scoping for policy and technical tools
- Identify data sources for climate scenario modeling

2013 CLG Meeting Schedule

- April 24, 2013
- July 17, 2013
- September 18, 2013
  - Locations to be determined based on design and construction schedules
  - Two project updates will be provided before the next meeting

Project Contacts

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- Heather Elmer – Collaboration Lead
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- Jay Dorsey – Applied Science Investigator
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- Breann Hohman and Crystal Dymond
  - bhohman or cdymond @eriecounty.oh.gov 419-626-5211
- Ona Ferguson – Consensus Building Institute
  - ferguson@cbuilding.org 617-844-1127