FLORIDA'S EROSION PREVENTION AND SEDIMENT CONTROL APPROACH

SASHTO Conference

August 21-24, 2011

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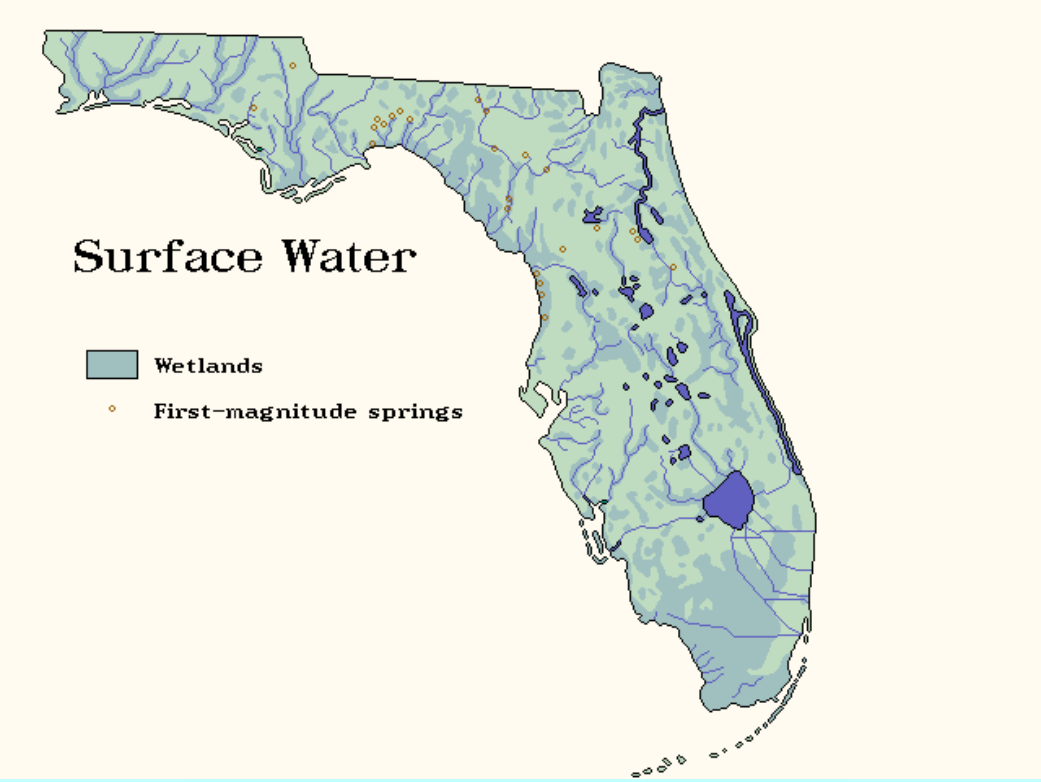
FDOT

FLORIDA'S WATER

- The State of Florida contains approximately 11.5 million acres of wetlands and 7.5 million acres of water (rivers, lakes, streams, and estuaries).



FLORIDA'S WATER

- Our wetlands and waterbodies function as nursery grounds, commercial fisheries, recreational areas, and tourism hotspots.

FLORIDA'S WATER

- Given the significant economic and environmental importance of our wetlands and waterbodies, water quality is a top priority in the State.

CONSTRUCTION

- Construction projects have been identified as sources of pollution that may degrade water quality.

CONSTRUCTION

- Runoff of eroded soils and discharge of turbid water during construction are two potentially significant impacts to water quality in the State.

CONSTRUCTION

- Erosion dislodges soil particles from the substrate where they can be carried off site and deposited into wetlands or surface waters.

CONSTRUCTION

- Turbid water discharged into wetlands or surface waters can block sunlight, inhibiting primary production and affecting the biological health of the system.

CONSTRUCTION

- The Florida Department of Transportation(FDOT) let approximately 500 construction projects last year with an annual work program budget of almost 2 Billion dollars.

- Due to the size of our work program and the amount of wetlands and surface waters in our state, the Department is very aware of water quality standards and regulations pertaining to construction projects.

WATER QUALITY

- Since erosion and offsite discharge of sediment and turbid water have such a large potential to impact surface waters, they are very well regulated by the Florida Department of Environmental Protection (FDEP) and the five Water Management Districts (WMDs) found throughout the State.

- The Department must address erosion and sediment control in two different permits on every project it undertakes.

WATER QUALITY

- Water quality associated with construction is regulated by the FDEP and the five WMDs under two different permits:
  - Environmental Resource Permits (ERP), and
  - National Pollutant Discharge Elimination System (NPDES) stormwater permits.

ERP PERMITS

- ERP permits are issued by the WMDs and are acquired by FDOT during the Design phase of a construction project for wetland impacts and the movement and storage of surface waters associated with construction.
    - Wetland mitigation
    - Stormwater treatment

ERP PERMITS

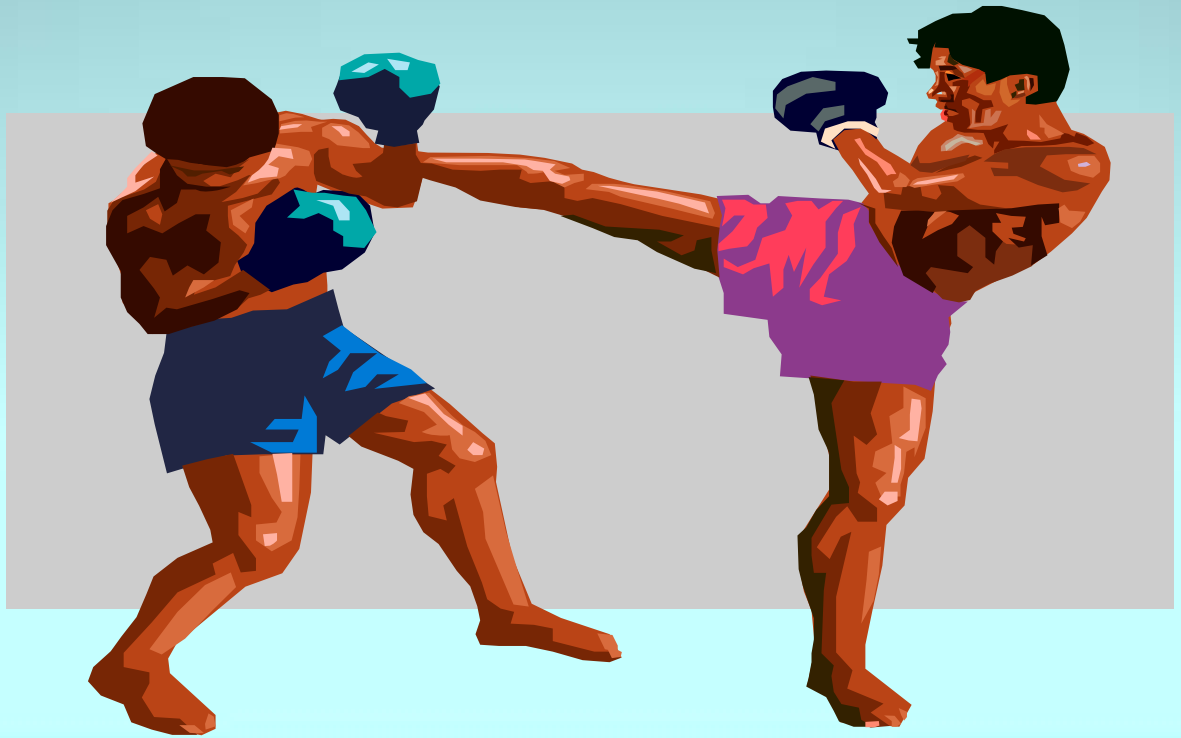
- One requirement of the ERP permit is to submit an erosion control plan that provides the WMD with assurance that FDOT will not violate state water quality standards during construction. Current Florida standards for turbidity are:
  - 29 NTUs above background of the receiving water body, and
  - 0 NTUs above background for designated special waters.

NPDES STORMWATER PERMITS

- NPDES stormwater permits regulate stormwater discharges associated with construction activities.
- Sediment and turbid water from construction cannot leave the project site.
- A Stormwater Pollution Prevention Plan (SWPPP) must be developed and implemented for each construction site covered by the permit.
- The SWPPP should detail all of the Best Management Practices (BMPs) used to prevent erosion and control sediment on the project site.

WATER QUALITY

- Historically, the goal of water quality regulation and the task of project construction has put State agencies at odds with each other!



WATER QUALITY

- Based on these differing goals and some significant history between the agencies, how did FDOT proceed when we began updating our erosion prevention and sediment control materials, standards and specifications?

COLLABORATION!!!

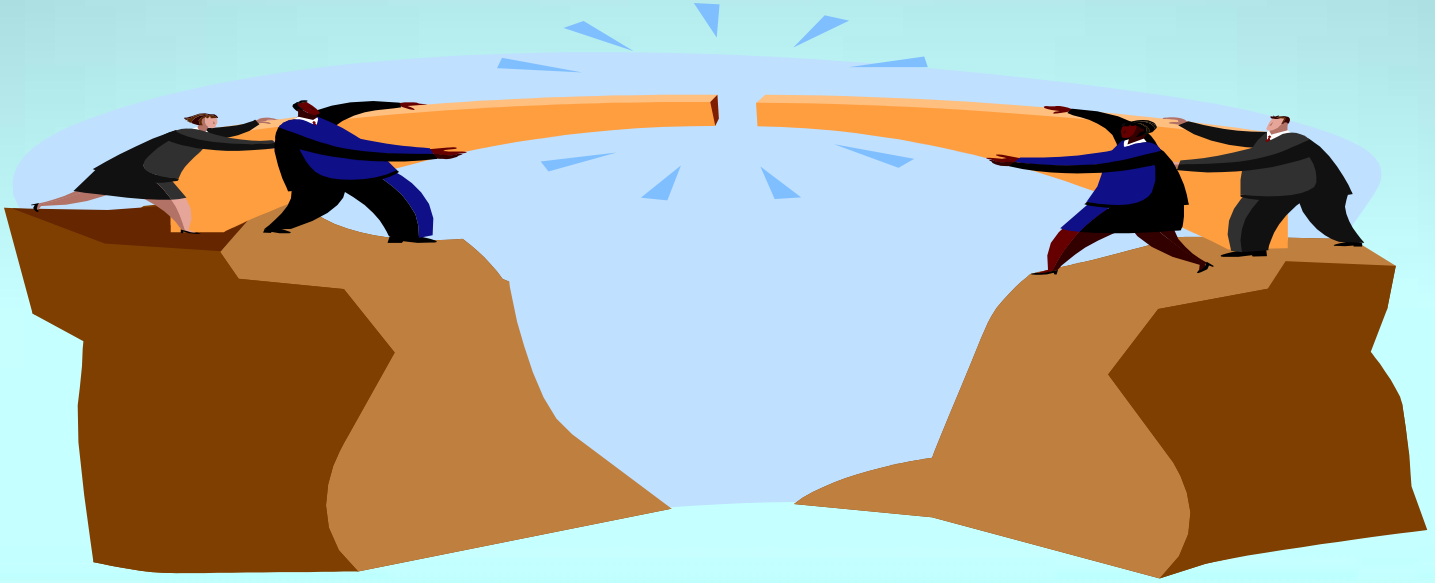
COLLABORATION

- The Department determined that the best way to ensure compliance with regulations as we developed new materials and specifications was to request direct involvement with the regulatory agencies.

- FDEP and the WMDs recognized a chance to have input on documents that guide a large percentage of construction work within the State.

COLLABORATION

- The result has been multiple joint efforts in the development of a new designer and reviewer manual, a developmental specification for lump sum payment for erosion prevention and sediment control and performance criteria for BMPs.



DESIGNER AND REVIEWER MANUAL

- FDOT was interested in developing new guidance materials for personnel responsible for designing and reviewing erosion control plans and SWPPPs.
- The Department wanted the guidance to be based on sound engineering principles and provide a solid technical background for choosing erosion and sediment control materials and methods in the field.
- Finally, we wanted it to be useful on a statewide basis for all types of constructions projects.

DESIGNER AND REVIEWER MANUAL

- The Department recognized that in order for our Manual to be successful on a statewide level, we would have to get buy in and concurrence with the regulatory agencies.

- Their direct involvement ensured consistent information and practices were being presented to the contracting community.

DESIGNER AND REVIEWER MANUAL

- FDOT contracted with the Stormwater Management Academy at the University of Central Florida (UCF) to review current erosion and sediment control practices, coordinate meetings between multiple government agencies and industry representatives and produce the guidance document.

- The University established a Manual Advisory Committee who was charged with reviewing all content.

ADVISORY COMMITTEE

- Included members from: FDOT, FDEP, USGS, WMDs, Applied Polymer Systems, Hydrodynamics, Inc., and UCF.

- Committee met several times over the course of 2 years to discuss the manual's format and to select materials and methods found in the document.

- Even though we didn't always agree, the open and direct dialogue allowed the committee to overcome obstacles quickly and move on.

RESULTS !

STATE OF FLORIDA

EROSION AND SEDIMENT CONTROL

DESIGNER AND REVIEWER MANUAL

June 2007

Prepared for:

FLORIDA DEPARTMENT OF TRANSPORTATION

&

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Tallahassee, FL

MANUAL CONTENTS

- Five separate sections covering different aspects of the Stormwater Pollution Prevention and Erosion Control Plans.

- Five appendices that cover specific scenarios and provide inspection forms and typical detail examples.

MANUAL CONTENTS

- Section I – General Information
- Section II – Developing Effective SWPPPs and Erosion & Sediment Control Drawings
- Section III – Erosion Control Methods
- Section IV – Sediment Containment Systems
- Section V – Temporary Construction Site BMPs

TEMPORARY BMPs

- Most current BMPs and methods
  - Selection – when to use / when NOT to use
  - Maintenance – when and how often
  - Installation – typical details

ROLLED EROSION CONTROL PRODUCTS

STATE OF FLORIDA EROSION & SEDIMENT CONTROL - DESIGNER & REVIEWER MANUAL

Rolled Erosion Control Product for a Drainage Channel

WHAT IS ITS PURPOSE?

To protect a drainage channel against erosion due to flowing water.

WHERE AND HOW IS IT COMMONLY USED?

- In drainage channels where vegetation needs to be established and significant flows occur.

WHEN SHOULD IT BE INSTALLED?

- While construction activities are occurring.
- After Grading activities are finished.

WHEN SHOULD IT NOT BE INSTALLED?

- Over impervious surfaces.
- On very rough ground.

WHAT NEEDS TO BE INSPECTED?

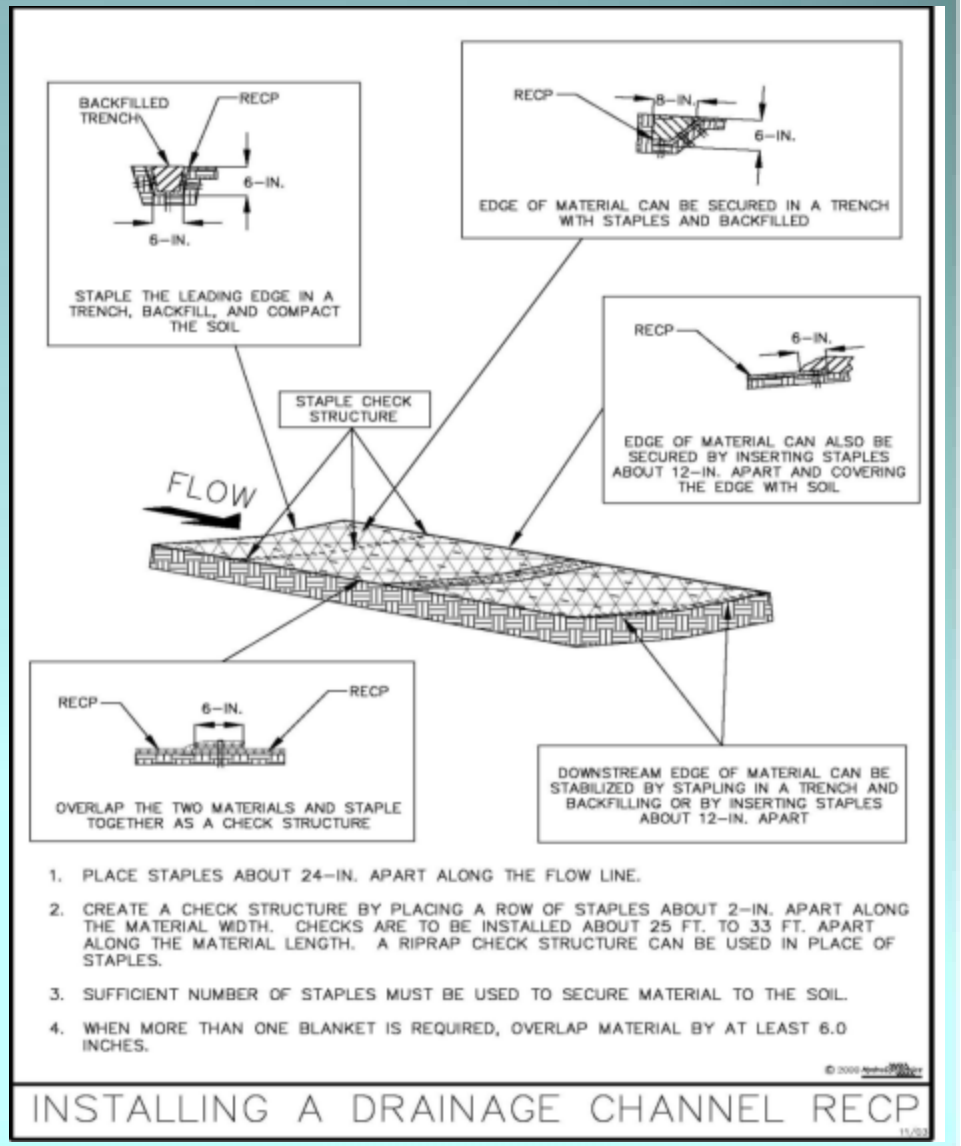
- Does the RECP display any damage?
- Was the channel bed smooth when the RECP was installed?
- Have check structures (staple or trench) been installed?
- Is water flowing under the blanket and causing erosion?
- Are sufficient numbers of staples used?
- Is the correct material used?
- Was seed planted before installing the RECP?
- Should straw mulch be used?

WHAT MAINTAINENCE ACTIVITIES CAN BE EXPECTED?

- Repair and replacement of material.
- Repair of eroded ground.

NOTES

- Erosion Control Blankets (ECBs) are composed of natural material including straw, straw-coconut, coconut (or coir), wood excelsior, and so forth. They must be held in place with netting sewn on both sides of the material.
- One type of Turf Reinforcement Mats (TRMs) is composed of 100% polypropylene or nylon and held in place with netting sewn on both sides of the material.
- Another type of TRM is composed of straw-coconut or coconut matter reinforced with strands of polypropylene threads and all held in place with netting sewn on both sides of the material.
- Designers must complete shear stress and velocity calculations in selecting an ECB or TRM for drainage channels.
- Additional information about ECBs and TRMs can be found at www.ectc.org.



SLOPE DRAINS

STATE OF FLORIDA EROSION & SEDIMENT CONTROL - DESIGNER & REVIEWER MANUAL

Slope Drain for Small Basins

WHAT IS ITS PURPOSE?

To protect hillside surfaces against erosion due to concentrated flows of runoff waters.

WHERE AND HOW IS IT COMMONLY USED?

- On fill slopes.
- On cut slopes.

WHEN SHOULD IT BE INSTALLED?

- While construction activities are occurring.
- After Grading activities are finished.

WHEN SHOULD IT NOT BE INSTALLED?

- When contributory basins are large (usually greater than five acres).

WHAT NEEDS TO BE INSPECTED?

- Are there areas where the earthen berm has been breached?
- Is water flowing around the slope drainpipe?
- Is water discharging onto an embankment?
- Is the pipe secured to the hillside?
- Is there protection (i.e. riprap) at the end of the slope drain?

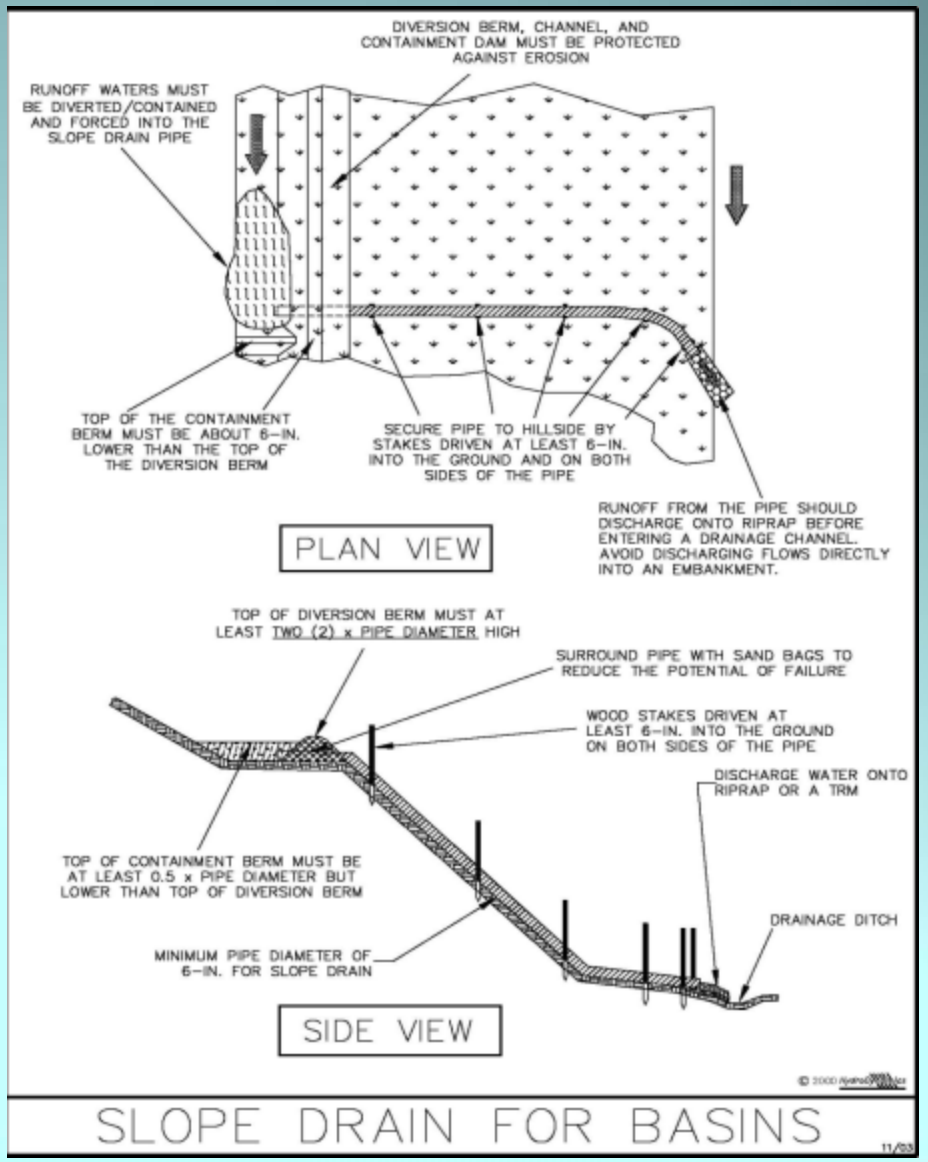
WHAT MAINTAINENCE ACTIVITIES CAN BE EXPECTED?

- Repair or replacement of slope drain.
- Replacement of riprap.
- Repair breached sections of earthen berm.

EQUATION USED TO CALCULATE PIPE DIAMETER:

$$D = 4.29 \times Q^{0.50} = 4.29 \times (CiA)^{0.50}$$

Where D = Pipe diameter (inches)
Q = Peak flood flow for the design storm event (cfs)
C = Runoff coefficient
i = Rainfall intensity (inches/hour)
A = Contributing area (acres)



INLET PROTECTION DEVICES

Frame & Filter Barrier for Area Drain (a.k.a. Drop, Catch Basin, or Ditch Bottom) Inlets

WHAT IS ITS PURPOSE?

Temporary barriers to cause waters to pond and drain so that sediment can settle out of runoff waters while construction activities occur.

WHERE AND HOW IS IT COMMONLY USED?

- Around median inlets.
- Around inlets to which runoff flows.

WHEN SHOULD IT BE INSTALLED?

- While construction activities are occurring.
- Only where "sump" conditions exist.

WHEN SHOULD IT NOT BE INSTALLED?

- After construction activities are completed.
- Where "sump" conditions do not exist.
- In locations that could lead to potential flooding such as encroachment on travel lanes of a roadway.

WHAT NEEDS TO BE INSPECTED?

- Has the unit been placed over the grate?
- Is there sufficient soil or gravel to seal the cover?
- Does accumulated sediment cover 2/3 of the filter barrier height?
- Does it appear that runoff is flowing under the fabric material?
- Do "sump" conditions exist?
- Is the fabric material torn?
- Is the frame still supporting the fabric material?
- Does runoff drain through the fabric material?

WHAT MAINTAINENCE ACTIVITIES CAN BE EXPECTED?

- Repair and replacement of gravel in the pocket.
- Replacement of fabric material.
- Removal of sediment around the unit.

NOTES

- These barriers are to be installed in "sump" conditions only. If placed in front of inlets on a grade, runoff will be diverted to downstream locations and could cause flooding.
- It is critical that a good seal exist between the ground and fabric material using adequate amounts of soil or gravel.
- Multiple types of filter media are available for this system. The correct type of filter fabric should be chosen that considers both safety and environmental concerns.

STATE OF FLORIDA EROSION & SEDIMENT CONTROL - DESIGNER & REVIEWER MANUAL

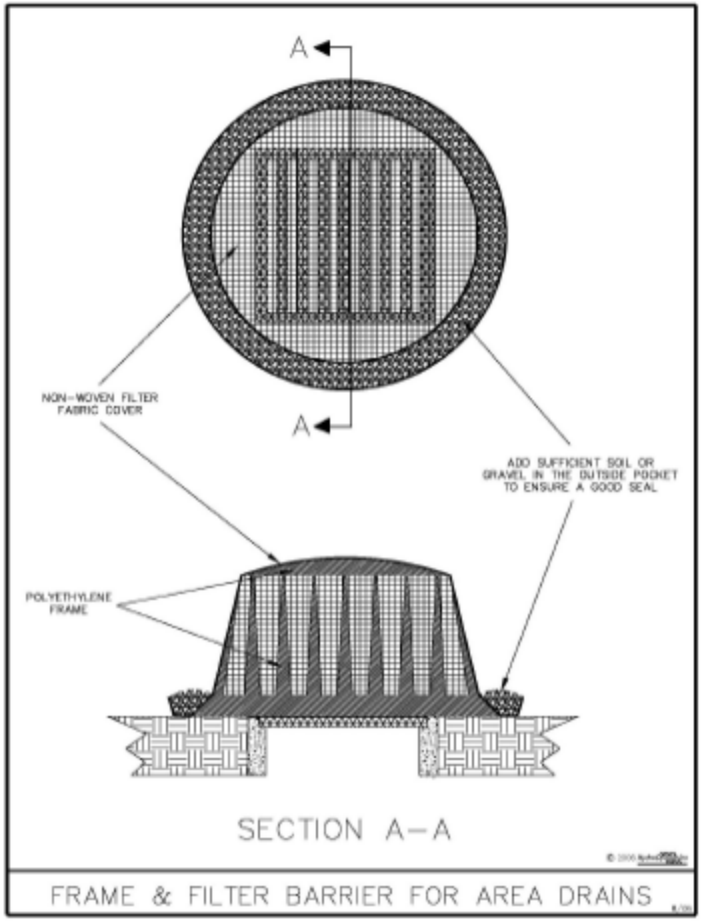


Figure V-47: Illustration of a Frame & Filter Barrier for Area Drains

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APPENDICES

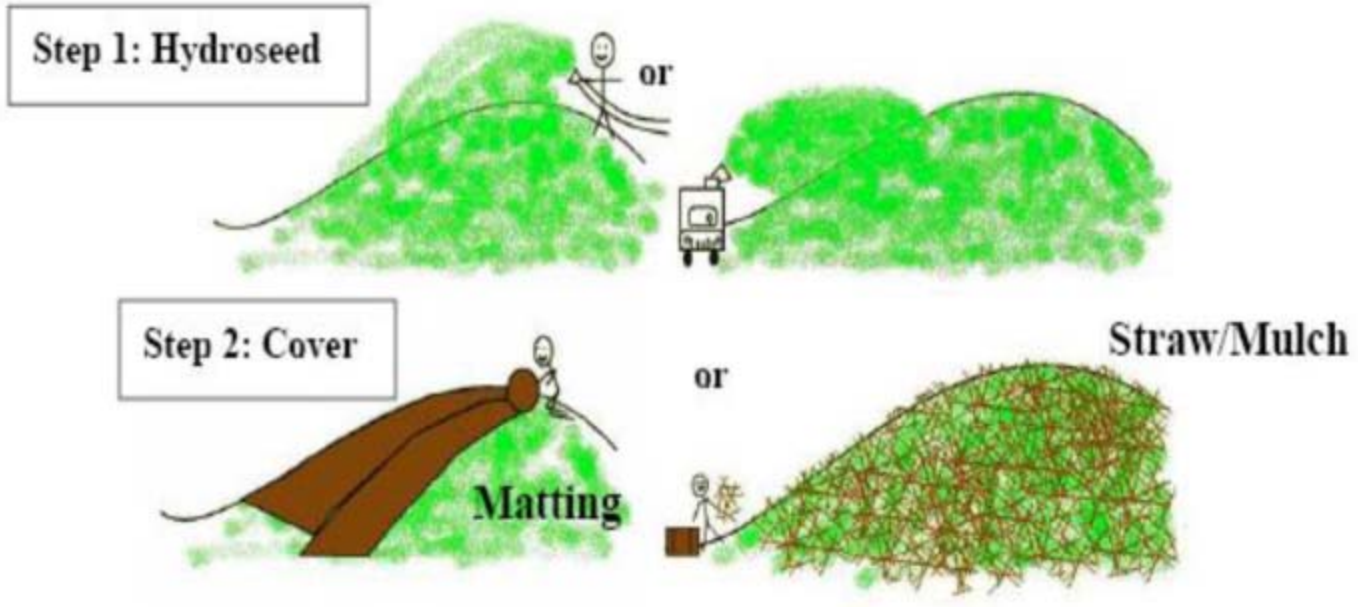
- Appendix I – Coastal Applications
- Appendix II – Dewatering
- Appendix III – Polymers and Alum
- Appendix IV – Inspection Forms
- Appendix V – Big Box / Highway Erosion and Sediment Control Plan typical details

POLYACRYLAMIDES (PAM)

- Water-soluble anionic polymers that are used:
  - to minimize soil erosion,
  - to decrease loss by binding soil particles, especially clays, and
  - as a water treatment additive to remove suspended particles from runoff.

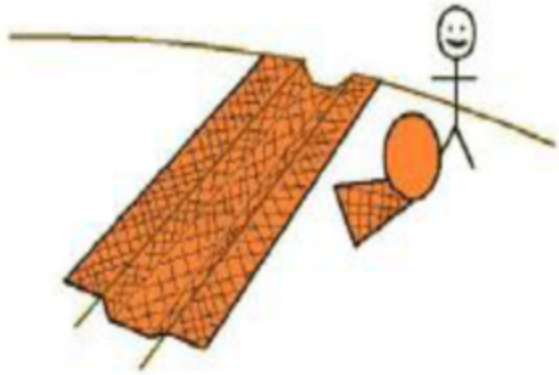
- All Agencies involved in this Manual recognize the potential of PAMs for preventing erosion and controlling sedimentation.

FROM THE SIMPLE…

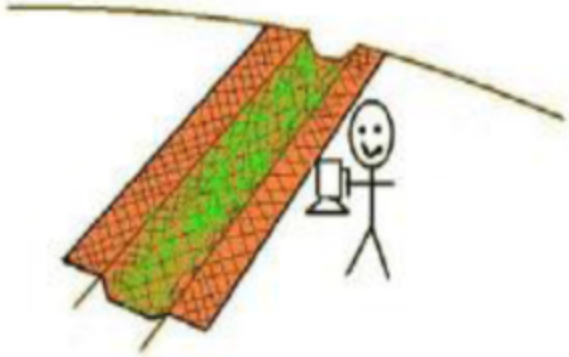


Limitations: Soil Samples must be tested for effectiveness so that a performance based criteria is implemented. Other limitations include slope steepness, type of clay (solubility, swelling characteristics, etc.)

POLYACRYLAMIDE APPLICATION



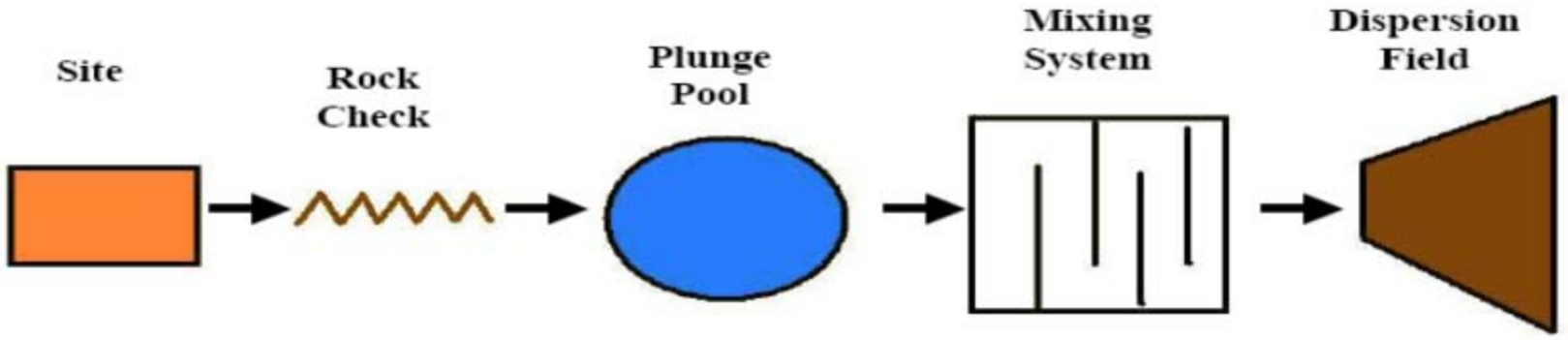
Step 1: Matting



Step 2: Apply powder

Limitations: Soil Samples must be tested for effectiveness so that a performance based criteria is implemented. Other limitations include slope steepness, type of clay (solubility, swelling characteristics, etc.)

TO THE NOT SO SIMPLE!



POLYACRYLAMIDE ENHANCED WATER TREATMENT SYSTEMS

RESULTS

- All of the agencies involved were pleased with the outcome and agreed to move forward with full implementation.

- The Department began writing a new specification that requires contractors on FDOT projects to use the Designer and Reviewer Manual as their guidance document for developing their erosion control plans and making BMP selections in the field.

- FDEP amended their rules to reference the Designer and Reviewer Manual as the standard guidance document for permit applicants to follow when developing erosion control plans for ERP permits and SWPPPs for NPDES stormwater permits.

RESULTS

- FDOT was so impressed with the results of the collaborative approach, that we have continued to partner with regulatory agencies for new erosion prevention and sediment control projects.

MANUAL TRAINING CLASS

- The Manual Advisory Committee followed up the production of the Designer and Reviewer Manual with the development of a three day training class to show designers how to best use the information provided.

- Regulatory personnel helped teach the pilot classes and were able to provide their perspective on permit compliance and guidance on common mistakes made during construction.

- They were also able to show real world consequences of not maintaining effective erosion prevention and sediment control practices during construction.

DEVELOPMENTAL SPECIFICATION

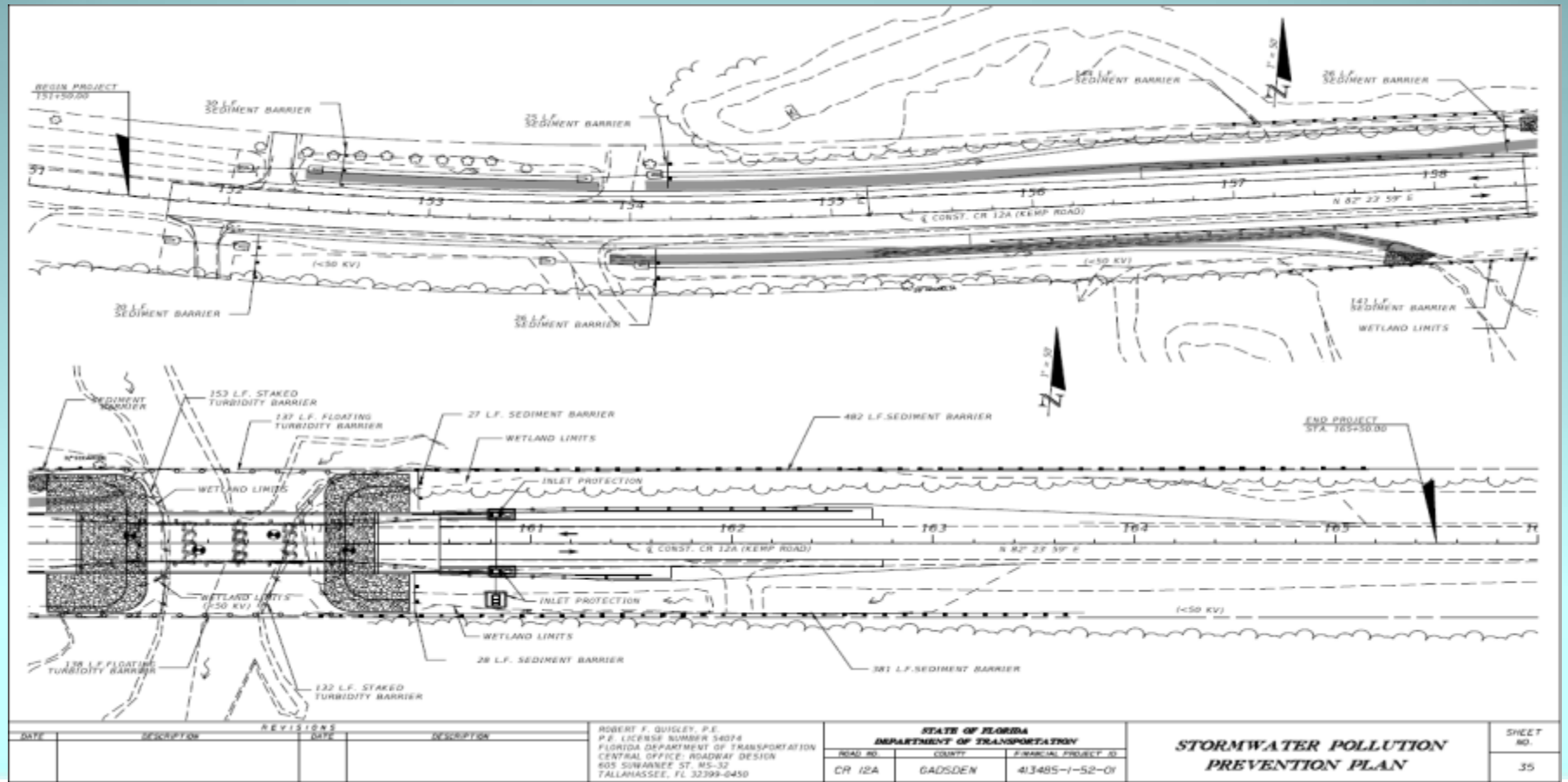
- FDOT took a significant amount of input and comment from FDEP and the WMDs regarding the development of a lump sum payment specification for the design, implementation and maintenance of erosion prevention and sediment control methods during the life of a construction project.

DEVELOPMENTAL SPECIFICATION

- Lump Sum payment for all aspects of erosion and sediment control.
- References the Designer and Reviewer Manual as the guidance document for designing erosion and sediment control plans.

DEVELOPMENTAL SPECIFICATION

- Requires the contractor to use a qualified Specialty Engineer to develop the erosion control plan.



DEVELOPMENTAL SPECIFICATION

- Requires the Specialty Engineer to make field visits in conjunction with the staging of a construction project to ensure that the plan he developed is being correctly installed in the field.

DEVELOPMENTAL SPECIFICATION

- Requires the Contractor's Engineer to submit his plan for review to FDEP or the WMD's before he can start work.
- Contains turbidity sampling criteria for each rain event measuring 0.50 inches or greater.

DEVELOPMENTAL SPECIFICATION

- We are currently using the developmental specification on 11 different projects around the State.

- As projects are finished, the Construction Office is receiving feedback from the Districts on the performance of the new specification as well as areas for improvement.

- We are still in the evaluation phase and do not have a specific time line for full implementation.

- Now that FDOT has a manual with design tools for developing erosion control plans and SWPPPs and is developing a specification requiring the Contractor to hire a competent Specialty Engineer to oversee the design and implementation of his erosion control plan, what's next?

PERFORMANCE BASED BMPs!

PERFORMANCE BASED BMPs

- The Department is often asked about product approval for temporary erosion prevention and sediment control BMPs.

- Historically, our product approval for temporary BMPs has been based on a review of the material properties of the product as well concurrence from a FDOT “expert”.

- These reviews were based on information submitted by the product manufacturer and were not good indicators of how they performed in the field.

PERFORMANCE BASED BMPs

- The Department wants to base its product approval on field performance instead of an office review.

- FDOT also wants to be able to set minimum performance criteria for types of products instead of approval on an individual basis.

- Finally, FDOT wants to list the performance criteria in the Designer and Reviewer Manual and Specifications for each BMP to aid in product selection.

GETTING STARTED

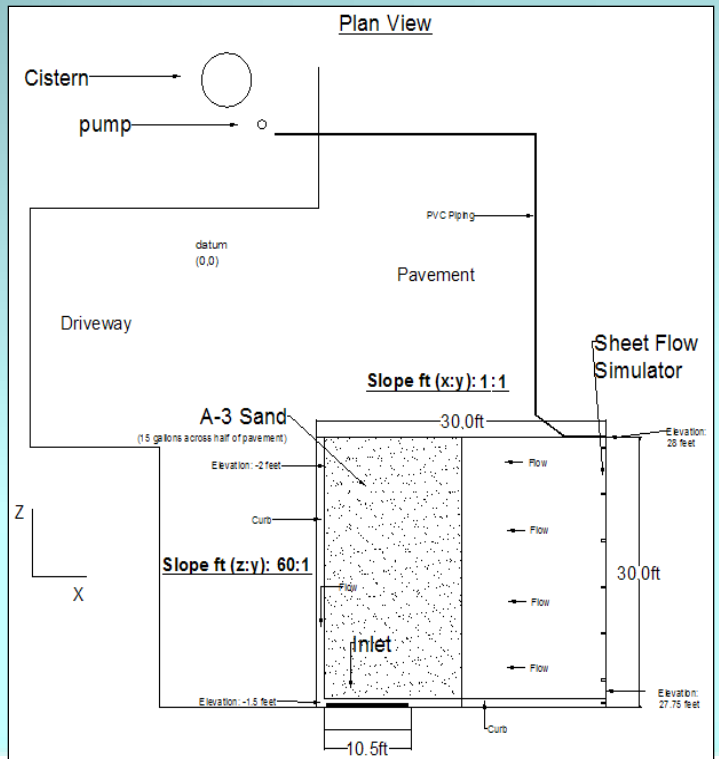
- FDOT contracted with the University of Central Florida to study the effectiveness of inlet protection devices for both curb and drop inlets.

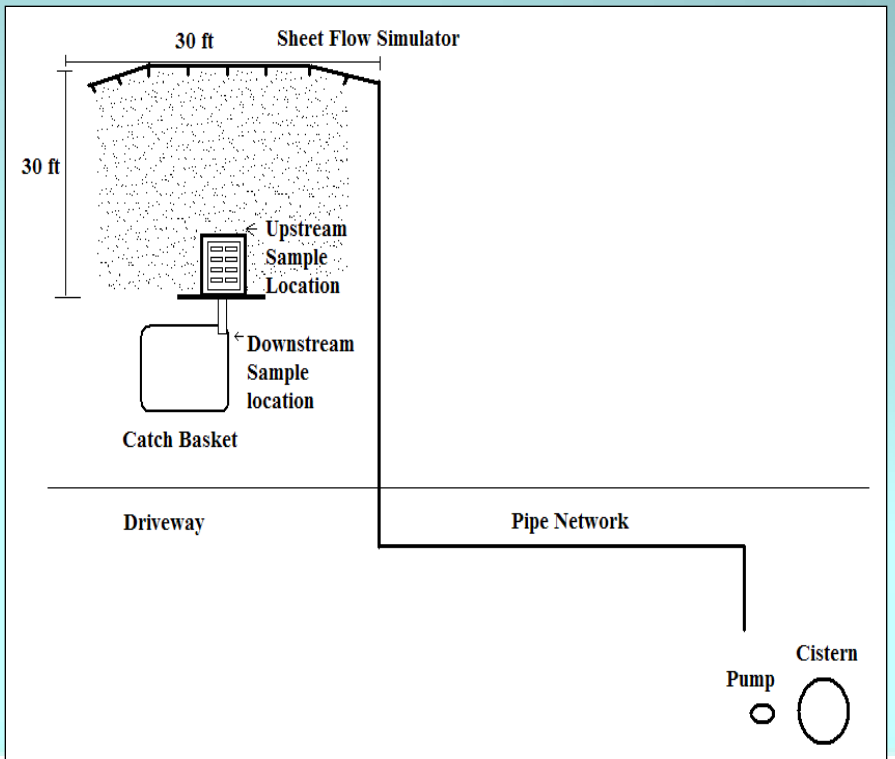
GETTING STARTED

- Thirteen different inlet protection devices were evaluated for flooding and pollution potential removal.

GETTING STARTED

- Each device was subjected to three different trials of 0.50 inch rain events with water quality samples taken before and after passing through the inlet protection device.

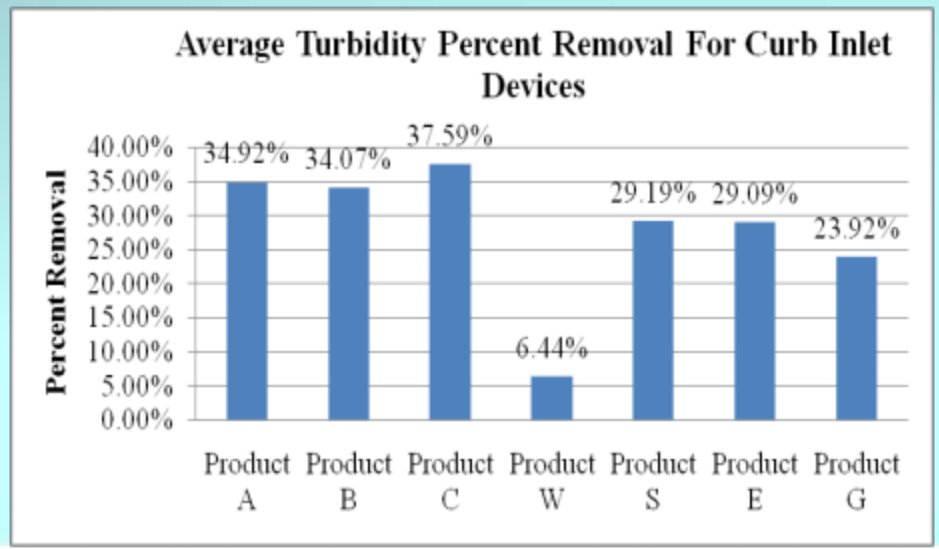


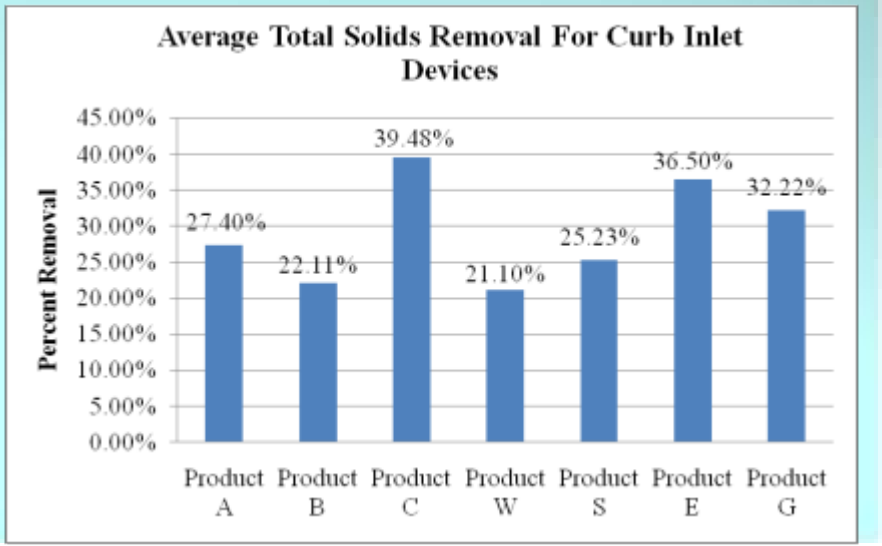


GETTING STARTED

- Each of the water samples was tested for turbidity, total solids, pH, alkalinity, and nutrients.

- Results were analyzed to evaluate the performance of each product in a field setting and to look for possible performance trends.





WHAT'S AHEAD?

MOVING FORWARD

- Currently, the Department is scheduling meetings with our regulatory partners to discuss the results of this project and any implications it may have on the Designer and Reviewer Manual.

- UCF is re-assembling the Manual Advisory Committee to discuss updates and changes to the Designer and Reviewer Manual.

- We are continuing research on performance based standards for BMPs with new projects for effectiveness of silt fence and field application of polymers.

MOVING FORWARD

- The last several years of collaboration between agencies have gone a long way toward erasing some commonly held misconceptions from all sides.

- The Florida Department of Transportation will continue to establish and maintain effective partnerships with the regulatory agencies to ensure that we deliver our roadway projects as efficiently as possible, while protecting the quality of one of our State's best resources.

QUESTIONS ???

LINKS!!

UCF Stormwater Management Academy -
http://www.stormwater.ucf.edu/

State of Florida Erosion and Sediment Control Designer and Reviewer Manual -
http://www.dot.state.fl.us/construction/Engineers/Environment/Environment.shtm

Inlet Protection Devices and their Effectiveness –
http://www.dot.state.fl.us/research-center/Completed_RD.shtm