Final Programmatic Report for
Chesapeake Bay Stormwater Training Partnership
Phase 2

Chesapeake Stormwater Network, June 2014
NFWF GRANT ID NO: 27285

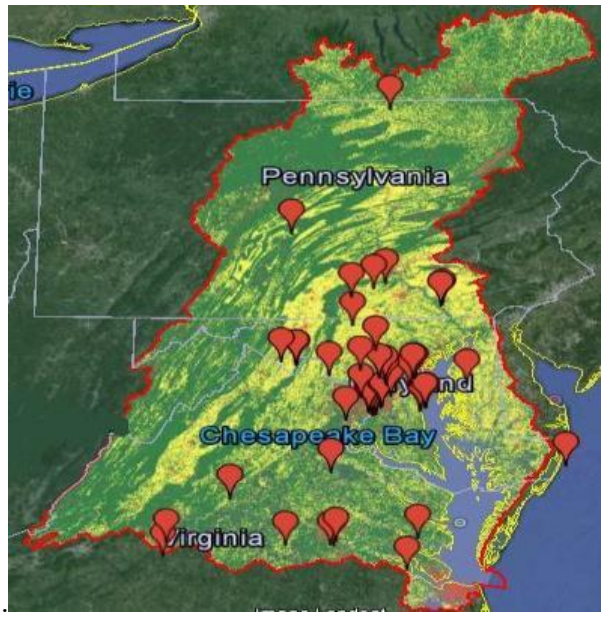
Part 1 Introduction

This report outlines the work conducted in the second phase of the Chesapeake Bay Stormwater Training Partnership (CBSTP) from January 2012 to June 2014. The CBSTP consists of a partnership between Chesapeake Stormwater Network (CSN), Center for Watershed Protection (CWP), Alliance for Chesapeake Bay (ACB) and Stormwater Management Consultants (SMC). The report begins by describing the progress made in meeting the project objectives outlined in the original work plan. Next, the report provides more detail on the activities performed over the last 30 months, and an assessment of how they influenced project outcomes. The last section describes the overall impact of CBSTP in promoting more widespread implementation of more effective stormwater practices with greater nutrient reduction.

Part 2 Performance in Meeting Grant Objectives

1. *Provide direct training to more than 1500 stormwater professionals in the Bay through webcasts, workshops, field training, and online training modules*

   We exceeded this objective by training 6700 individuals and hosting workshops in ALL of the Bay states. In the map below, you can see the locations at which we held in-person training events.



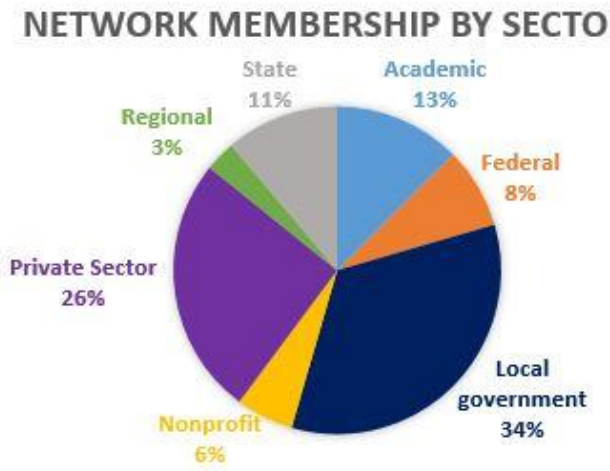
- Held 68 training events in 30 months in the form of workshops, webcasts, presentations, and retreats.
- Created and updated 43 new training modules.
- Our "College of Stormwater Knowledge" website attracted more than 150,000 visitors and prompted about 40,000 downloads of training materials

2. *Offer more than 15,000 person hours of training*

We exceeded this objective by providing 28,400 hours of direct training- a figure that does not account for online training hours which are difficult to measure. We offered more training hours in Phase 2 than Phase 1 of this grant.

3. *Develop the capability to communicate with over 5000 stormwater professionals*

We exceeded this objective by increasing the network size from 1200 to 6700 members. The members in our network represent all seven Bay states and an even wider range of sectors. The graph below shows how each sector is represented in our network.



**This data is based on the 4225 email addresses that have been assigned to a sector. Most of the remaining email addresses are most likely part of the nonprofit or private sector.*

- Increased interactivity with our network through 37 email alerts, the Best Urban BMP in the Bay Awards (BUBBAs), automated webcast registration, website updates, and archived webcasts that quadrupled our traffic by promoting network engagement

- The primary CBSTP partners, CWP and CSN, were ranked as the most trusted sources for stormwater information in the Chesapeake Bay watershed in both the 2012 and the 2014 network surveys.

4. *Train 200 individuals to become master stormwater practitioners*

   We exceeded this objective by holding four Master Stormwater Practitioner workshops in Charlottesville, Howard County, Fairfax, and Richmond for 200 individuals.

   - The CBSTP also conducted 7 Advanced Stormwater Design webcasts that reached a total of 659 people or an average of 94 people per webcast

5. *Create LID installation and maintenance program for inspectors and landscape contractors*

   We met this objective by producing and distributing three different videos in both English and Spanish on proper LID construction, inspection, and maintenance to over 100 landscape contractors in the watershed community.

   - Provided desktop and field training for more than 100 inspectors/maintainers
   - Developed seven new training modules for this audience
   - Released a smart phone/tablet on visual indicators to inspect LID practices

6. *Produce user-friendly stormwater nutrient accounting and tracking methods*

   We met this objective by developing nine new training modules on how to get nutrient and sediment reduction credits for urban BMPs and restoration practices.

   - Rolled out WIP and nutrient accounting guidance in 12 webcasts and 12 workshops, collectively reaching an audience of 1500 individuals
   - The CBSTP served as one of the few sources of technical outreach on local TMDL implementation during the 30 month period of the grant

7. *Prepare and distribute practical tools and resources that practitioners can use to design, build, and inspect better practices*

   We met this goal by creating a series of practical products and resources that practitioners can actually utilize to improve on the ground implementation. Key examples include:

   - Stormwater compliance sheets in DC, MD, PA, VA, and WV
   - The "Bioretention Illustrated" guide and smartphone app
   - The Homeowner Guide for a More Bay-Friendly Property
   - The nutrient cruncher tool and its inclusion into the SMART tool
   - Updates to the "College of Stormwater Knowledge" website

Tools and Resources Developed Under Phase 2 of the CBSTP	
Resource	Web link
State specific stormwater compliance spreadsheets	http://chesapeakestormwater.net/training-library/state-specific-resources/
DC	http://chesapeakestormwater.net/training-library/state-specific-resources/district-of-columbia/
MD	http://chesapeakestormwater.net/training-library/state-specific-resources/maryland/
PA	http://chesapeakestormwater.net/training-library/state-specific-resources/pennsylvania/
VA	http://chesapeakestormwater.net/training-library/state-specific-resources/virginia/
WV	http://chesapeakestormwater.net/training-library/state-specific-resources/west-virginia/
Bioretention Illustrated: A Visual Guide for Constructing, Inspecting, Maintaining and Verifying the Bioretention Practice	http://chesapeakestormwater.net/2013/04/technical-bulletin-no-10-bioretention-illustrated-a-visual-guide-for-constructing-inspecting-maintaining-and-verifying-the-bioretention-practice/
Bioretention Illustrated Inspection App	http://chesapeakestormwater.net/2014/02/inspection-app/
Homeowner Guide For a More Bay-Friendly Property	http://chesapeakestormwater.net/be-bay-friendly/
Crediting Residential BMPs	http://chesapeakestormwater.net/bay-stormwater/baywide-stormwater-policy/urban-stormwater-workgroup/crediting-residential-bmps/
SMART Tool Support	http://extension.umd.edu/watershed/smart-tool
Updated College of Stormwater Knowledge	http://chesapeakestormwater.net/training-library/

Part 3 CBSTP Activities and Outcomes

Activity 1: State-specific Stormwater Training

In this phase of the grant, we produced eight different training modules for state-specific stormwater training. These training modules included:

- DC Stormwater Regs and BMP Specs
- VA Stormwater Regs and BMP Specs
- Environmental Site Design to Maximum Extent Practicable in MD
- WV Stormwater Compliance Spreadsheet
- WV Stormwater Regs and BMP Specs
- PA Stormwater Manual and Spreadsheet

- Stormwater Management Compliance at Federal Facilities
- PA Chesapeake Bay Pollutant Reduction Plans

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Under this task, the Partnership continued to support implementation of new stormwater regulations in each of the Chesapeake Bay watershed states. In Phase 1 of CBSTP, we primarily worked within Maryland and Virginia, although we recognized the need to better engage with the other Bay watershed states in order to meet the goals of the Bay TMDL. Consequently, in Phase 2 the CBSTP expanded its focus to work with Pennsylvania, West Virginia , New York and the District of Columbia.

In addition, we have seen a shift to some of the states (specifically Maryland, Virginia, West Virginia and the District of Columbia) taking on more of the responsibility for training their stormwater population which we view as a successful outcome of the grant.

Workshop participants engaged in classroom and field exercises in Cumberland, PA (left) and Elmira, NY (right).

OUTCOME: According to this year's BMP Implementation Survey, the majority of respondents are now both familiar and comfortable with new state stormwater regulations and manuals. From 2010 to 2014 there was a 12% increase in the number of respondents that consider themselves "very knowledgeable" about their states' current stormwater design requirements. It is evident from this data that our efforts to produce and distribute comprehensive materials on state-specific regulations have resulted in a measurable increase in understanding and confidence in complying with new state stormwater regulations.

Activity 2 LID Inspector Training

Our surveys continue to show that LID maintenance and inspection concerns remain the top concern of stormwater professionals in the Bay. We developed seven new training modules for this audience. These modules consisted of:

- Practical Guide to LID Maintenance
- Visual Indicators for LID Inspections

- Visual Indicators for Ponds and Wetlands
- Construction Inspection for LID Practices
- Developing an Effective Local Maintenance Program
- Forensic BMP Investigations
- Construction and Inspection of Homeowner BMPs.

At least one training module was incorporated into 12 workshops and presentations. We were also able to get out into the field and conduct an intensive desktop and field training session in both Richmond and Fairfax County, VA.

Workshop participants learn about inspection of LID in Richmond, VA (left) and Howard County, MD (right).

The CBSTP created a comprehensive, visual guide to proper installation, inspection and maintenance of LID practices. Our guide, called *Bioretention Illustrated: A Visual Guide for Constructing, Inspecting, Maintaining and Verifying the Bioretention Practice* outlines a new model for efficiently inspecting and maintaining practices over the life cycle of the BMP. Relying heavily on a visual approach, *Bioretention Illustrated* takes the individual step-by-step through the inspection process for five different LID practices (bioretention, grass channels, filter strips/sheet flow to buffers, permeable pavement and infiltration).

In this way each LID practice can be rapidly inspected in a fraction of the time that it takes to inspect the larger, more traditional practices. The objective is that anyone who has been trained in using visual indicators can effectively inspect an LID practice, thereby creating a whole new inspection workforce.

The CBSTP also recognized the advantage of automating the process to increase the efficiency of inspections. In response to this, we created the "Bioretention Illustrated App." This smart phone or tablet-based app follows the approach of our *Bioretention Illustrated* guide and allows users to conduct rapid inspections of individual bioretention practices in the field. The app takes the user step-by-step through each of the visual indicators and prompts the user to 'rate' each indicator (per the guidance in the technical guide) and upload photos to document each of the indicators. Finally, the app generates a pdf report of the inspection (complete with photos) and creates a punch-list of

maintenance activities required to bring the practice up to speed. Currently the app has only been developed for the bioretention practice but it is considered "open source" and can be adapted for use with other stormwater practices.

OUTCOME: The tools, resources, and training materials developed and successfully piloted by the CBSTP helped to overcome many local LID maintenance challenges. However, more work needs to be done in Phase 3 to disseminate these materials to more MS4 communities.

Activity 3 Landscape Contractor Training on LID Maintenance

In order to target our new audience of landscape and general contractors, we produced three 15-minute videos explaining proper LID construction, inspection, and maintenance. These videos were produced in both English and Spanish. These videos were distributed to approximately 75 landscape contractors and local governments.

OUTCOME: We were able to fill much of the need for increased LID knowledge in this population, but we need to perform more outreach to fully serve this hard-to-reach audience in Phase 3 of the CBSTP.

Activity 4 LID Training for Federal Facilities

In Phase 2 we conducted the largest ever training workshop for federal facility managers on how to comply with the Bay TMDL. Over 40 different agencies participated in this workshop as well as a supplemental webcast, including the:

Architect of the Capitol, Army National Guard, Department of Homeland Security, Department of Veterans Affairs, Food and Drug Administration, Fort Detrick Environmental Management Office, General Services Administration, National Aeronautics and Space Administration, National Park Service, Naval Facilities Engineering Command, Naval Support Facility, U.S. Army, U.S. Army Corps of Engineers U.S. Coast Guard, U.S. Department of Agriculture, U.S. Department of Energy, U.S. EPA, US Fish & Wildlife Service, U.S. Naval Academy and the U.S. Secret Service.

OUTCOME: While the workshop was very successful, it has been extremely difficult to partner with this target audience to schedule any follow-up training events, though not for lack of trying.

Activity 5 Stormwater Retrofit Training

Our network has consistently ranked learning more about stormwater retrofits as their top training need in all of the surveys we have conducted in the last six years. In order to address this demand, the CBSTP developed nine new training modules on stormwater retrofitting. These training modules included:

- Urban Watershed Assessments
- Basics of Stormwater Retrofits
- The Retrofit Discovery Process
- Field and Desktop Investigations
- Retrofit Field Indicators
- Ranking Priority Retrofit Projects
- Retrofit Design and Construction
- Retrofit Costs and Delivery

At least one of these retrofit training modules were incorporated into nine different workshops and five webcasts. Additionally, the CBSTP organized two multi-day workshops on stormwater retrofits in Fairfax County and Charlottesville, VA.

OUTCOME: While our efforts have fully addressed the need to develop technical training content, we have not fully met the local demand for retrofit training across the Chesapeake Bay watershed.

Activity 6: Training Master Stormwater Practitioners

Master Stormwater Practitioner (MSP) training typically involves intensive sessions for experienced professionals to learn advanced stormwater methods and practices. The MSP training is highly interactive, and provides participants with extensive technical resources and training materials that they can use to teach their own staff thereby further transmitting the information throughout the stormwater world to the people who need it.

Under Phase 2, the CBSTP continued to offer the MSP training but focused it in two main stormwater skill areas: Improved Protocols for Installing and Maintaining LID practices and Advanced Stormwater Retrofits for Nutrient Reduction. The CBSTP also continued to offer a few workshops on Advanced LID design for those communities that requested it.

In each of these skill areas, the CBSTP first worked to produce the training materials on the identified topic. After an initial dry run to test out the materials, the CBSTP refined the technical content based on feedback from workshop participants and offered another workshop with the revised content. Afterwards, all content was bundled into a complete training package and added to our website where local governments and other stormwater practitioners can download it and undergo the training on their own time.

Two MSP workshops on LID Maintenance and Inspection Protocols were held in Richmond, VA and Howard County, MD and had a combined attendance of 108 people. These workshops focused on using the visual indicators approach to construction, inspection and maintenance as is outlined in *Bioretention Illustrated*. Both workshops included field trips to nearby LID practices where participants had the opportunity to conduct an inspection with the new protocols and test out the Bioretention Illustrated App.

Based on evaluations taken at the end of the workshop, there was a significant increase in workshop participants' knowledge of LID inspections with 90% of people indicating a very high or decent understanding after the workshop as compared to only 54% prior to the workshop.

The two Advanced Retrofit Design workshops were conducted in Charlottesville, VA and Fairfax County, VA and had a combined attendance of 95 people. Both workshops covered how to maximize nutrient reduction through retrofitting, field investigation methods and design tools to estimate nutrient reduction from candidate sites. Again both workshops included a field component where workshop participants went out to potential retrofit candidate sites in the field and practiced using their newly learned retrofitting techniques.

Workshop participants learn about advanced retrofit techniques (left) and inspection of LID practices (right).

Based on evaluations taken at the end of the workshop, there was a significant increase in workshop participants' knowledge of retrofitting with 94% of people indicating a very high or decent understanding after the workshop as compared to only 38% prior to the workshop.

The CBSTP also developed nine training modules on advanced stormwater design that were featured in seven webcasts conducted in 2014:

- Bioretention Design
- Infiltration Design
- Soils and Soil Amendments
- Permeable Pavement Design
- Constructed Wetland Design
- Design of Rainwater Harvesting Systems
- Design of Filter Strips and Disconnections
- Grass Channel Design
- Homeowner BMP Design

OUTCOME: Our efforts expanded the number of highly skilled stormwater practitioners in the Bay watershed, but we have certainly not satisfied the local MSP training demand across the watershed. According to this year's BMP implementation survey, our network members are still looking to learn more about urban stormwater retrofits, urban stream restoration, crediting for homeowner BMPs, and urban nutrient management.

Activity 7 Training Locals on WIP Implementation

This was not much of a training need in Phase 1, but with the adoption of the Bay TMDL and new MS4 permits, the demand for this training has sky rocketed. The CBSTP has been virtually the only training provider in the watershed since the Bay TMDL requirements were established in 2009. In order to meet the training demand, we developed nine training modules and supporting resources, which included:

- Basics of Local Nutrient Accounting
- Urban Stream Restoration
- Urban Nutrient Management
- Stormwater Retrofit Practices
- Credits for New LID Practices
- Enhanced Erosion and Sediment Control Practices
- Homeowner BMP Crediting
- Urban BMP Reporting and Verification
- Retrofitting Federal Facilities.

Additionally, we featured information about nutrient accounting in 12 different webcasts that were attended by more than 1000 individuals

OUTCOME: The CBSTP has made great progress on this task during the grant period, but the demand for training on WIP implementation has increased and expert panel reports with new

information continue to be released. This means that this training activity will continue to be a major theme in Phase 3.

Activity 8 Tracking Improvements Over Time

CBSTP conducted two major surveys during the Phase 2 grant period, and compared them to similar baseline surveys that were taken in Phase 1 to determine rates of BMP implementation, as well as key training needs and preferences. Some of the key results from these surveys are provided in Part 4 of this report, and the full results of our 2014 BMP implementation survey are provided as an attachment to the final project submission.

OUTCOME: These survey results demonstrate significant and highly encouraging changes in stormwater professionals' knowledge and actual implementation of high performing practices from the baseline six years ago.

Activity 9 Communicate with CSN Network

In Phase 2, we not only expanded the size of the network, but also increased our interactivity with the network through frequent email blasts. In these email blasts we were able to provide vital research alerts and information about the BUBBAs. We also utilized our listserve to advertise the Annual BMP Implementation Survey and our free webcast series.

The emails to our listserve proved quite valuable as the day after they were sent, the number of survey respondents or individuals registered for our webcasts would increase significantly. Communication was also enhanced with the launch of our "College of Stormwater Knowledge" website in May of 2012 and frequent upgrades in our website and communication tools.

Since these changes were made, the growth of network members, website visitors, and product downloads have exceeded all of our expectations, particularly compared to what these figures were at the end of CBSTP Phase 1 (see summary statistics on Page 1-2 of this report).

OUTCOME: Overall, our communication strategy allowed us to have a larger and more consistent presence in the inboxes of our network members. We are reaching a much larger audience than we were two years ago and there is plenty of evidence to suggest that the stormwater practitioners who need or want the information are receiving it.

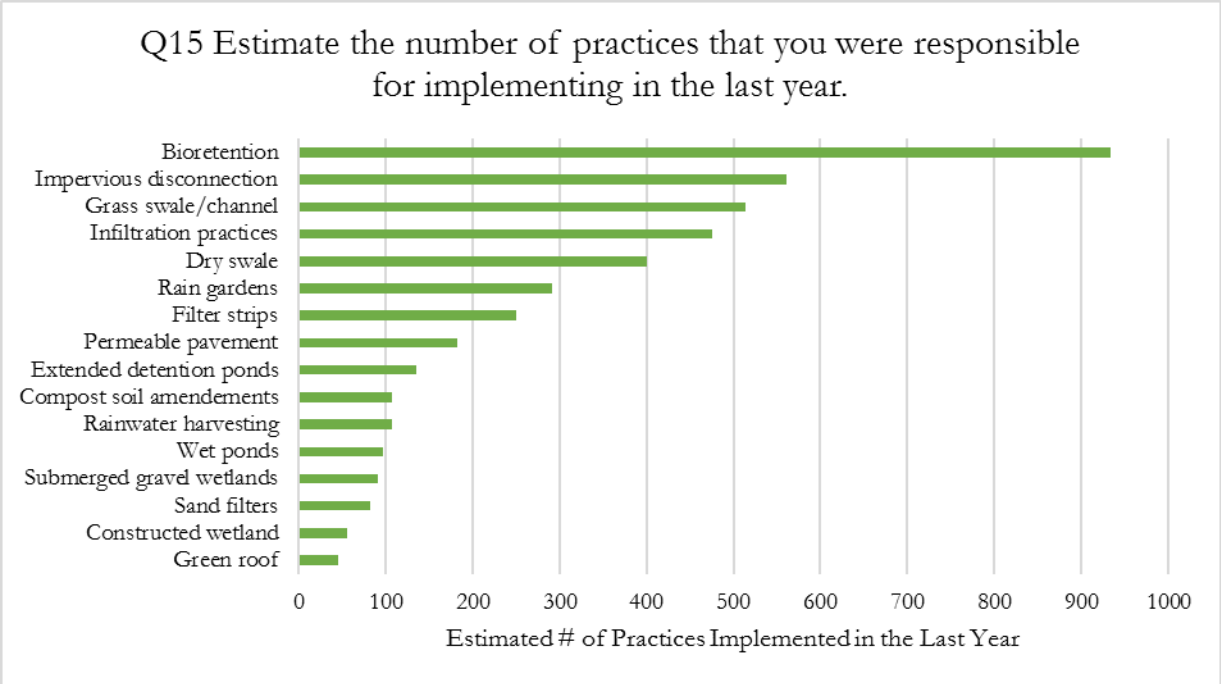
PART 4 Impact of CBSTP Phase 2 on Bay Stormwater Implementation

The CBSTP has had a measurable impact in accelerating the adoption of more effective nutrient reduction practices at new and redevelopment projects across the Bay, as well as retrofit and restoration practices to remove nutrients from existing development.

In our original baseline survey in 2009, only 40% of the BMPs installed were classified as "high performers" in terms of their ability to produce high levels of nutrient reductions. In our 2014

survey, more than 85% of the self-reported practices that are being implemented now could be classified as high performers.

The dramatic shift to high performing LID practices is evident in the chart below which was derived from our 2014 BMP implementation survey. As can be seen, the top eight practices that are being implemented are high-performing practices, whereas the number of conventional BMPs such as dry ED ponds and wet ponds has sharply declined. Several innovative LID practices that were rarely or never reported in 2009 are now being built, albeit in somewhat small numbers (green roofs, rainwater harvesting, submerged gravel wetlands, soil compost amendment, etc.)



This year's BMP Implementation survey also revealed that stormwater practitioners are implementing individual LID practices on smaller drainage areas, often less than one acre in size. The declining BMP drainage area over time is a strong indicator of the rate of LID adoption over time.

While the encouraging shift towards LID practices has been primarily driven by new state stormwater regulations, MS4 permits, and the Chesapeake Bay's TMDL requirements, the role of the CBSTP in accelerating it cannot be overlooked.

The main reason is that the CBSTP has been the only major stormwater training service provider across the Bay over the last six years. During this period, most Bay states were unable to provide adequate stormwater training/outreach, due to a lack of funds, personnel, expertise, and other reasons.

The CBSTP filled this gap by providing quality, high-level training throughout the Bay watershed that has made the transition to LID practices faster and easier than it would have otherwise been.

I. Things We Learned that Will be Applied to Phase 3 of CBSTP

In December 2013, CBSTP was awarded a third grant to continue the training partnership and focus on new training topics and audiences. As our project team enters the third phase, we plan to take advantage of the lessons learned in Phases 1 and 2. Some of the key strategies we will apply in the Phase 3 include:

- *Rely more heavily on webcasts to train our target audiences on their priority stormwater topics*. We have discovered that webcasts really drive down the unit cost per person-hour trained. The combination of our CSN network growth, automated registration, more reliable webcast platforms and existing content/speakers, means that we can reach 80 to 200 people per webcast for about 24 staff hours of effort. Our surveys and webcast evaluations both show that most of our Network likes the format and convenience, although some on-site, hands-on or field workshops are still needed from time to time.

- *Understand that repetition is needed to fully reach our audience*. We often forget that a single training event is not sufficient to reach all of the interested members of our network. Also, over time a lot of first-time stormwater professionals begin working in the Bay watershed. So going forward, we will repeat webcasts on a more consistent basis, and make greater efforts to consistently promote our archived webcasts as well as other existing resources on our website.

- *Shift from designers to installers and maintainers.* Our most recent survey indicates that many otherwise fine stormwater designs are being poorly constructed and/or maintained, and that this is one of the greatest concerns of our network. To meet this need, CBSTP will have to reach out to construction contractors, landscape architects, local inspectors and other new training audiences, which are notoriously hard to reach. In effect, this also adds a large foundation to our stormwater training pyramid, as the target audience is probably about 5000-10,000 in size.

- *Allocate limited CBSTP training resources to the highest priority targets*. We need to do a better job at delivering effective training to the regions/sectors that need it the most. For example, right now the greatest training gap exists in Pennsylvania, although it is easier to arrange training in other Bay states. Therefore, we are making a concerted effort in Phase 3 to focus on PA. We also need to get the other Bay states to take ownership for basic stormwater training within their own jurisdictions. We have had some success in shifting the training responsibility in VA, DC and WV, but need to work with other states to internalize and sustain these basic stormwater training programs.

Another example of targeting limited training resources relates to local WIP training. We are working on a contact database that would include all the regulated MS4s communities and the consultants that work with them. This will help us match the people that need to make the key decisions with timely information on how they can comply with the Bay TMDL.