NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

NEW CASTLE COUNTY MS4
Permit No. DE 0051071

submitted by
NEW CASTLE COUNTY DEPARTMENT OF SPECIAL SERVICES
as Lead Permittee

JOINT ANNUAL REPORT FOR CALENDAR YEAR 2008

Volume 2 of 2
DelDOT Report and Appendices

Permitees

New Castle County Department of Special Services
Delaware Department of Transportation
The Village of Arden
The Village of Ardentown
The Village of Ardencroft
The Town of Bellefonte
The City of Delaware City
The Town of Elsmere
The Town of Middletown
The Town of Newport
The City of New Castle
The Town of Odessa
The Town of Townsend
The City of Wilmington

Submitted May 1, 2009

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CERTIFICATION

I certify under penalty of perjury that this document and all attachments are true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations. As to the identified portions of this document for which I cannot personally verify their truth and accuracy, I certify as Delaware Department of Transportation's official having responsibility for the persons who, acting under my direct instruction, made the verification that this information is true, accurate, and complete.

4/27/09

James R. McNinch III, Director, Maintenance and Operations
Delaware Department of Transportation
800 Bay Road
P.O. Box 778
Dover, DE 19903
(302) 760-2201

Program Summary and Projection of Work

The objective of the Delaware Department of Transportation NPDES Program is to reduce stormwater pollutants from the co-permittees' municipal separate storm sewer system to the maximum extent practicable. This is accomplished through the implementation of a comprehensive stormwater pollution prevention and management program as contained in the NPDES Permit No. DE 0051071 effective May 1, 2001 and EPA Consent Decree effective December 14, 2001.

The Delaware Department of Transportation and New Castle County entered into an Interjurisdictional Agreement for the purposes of identifying duties and responsibilities under the Consent Decree and the stormwater NPDES permit. If any task listed requires consultant services, DelDOT and the County will share all costs equally. $2.46 million was appropriated to implement program elements of NPDES (Table A). This annual report covers NPDES activities from January 1, 2008 through December 31, 2008.

The purpose of this review and update is to summarize major activities to date through year 2008 and provide a projection of work for calendar year 2009. Work projections for 2009 are provided at the end of this section in Table B.

The following projects have been initiated as a result of the NPDES permit:

Storm Drain Inventory and Inspection

The storm drain inventory and inspection program began in August 2001 with DelDOT signing Agreement No. 1131 with URS Corporation for a period of five years. By the end of their agreement term, URS inspected 45,551 storm system structures and swales and culverts. Other work included inventory and inspection of stormwater BMPs and installation of storm drain markers.

Agreement 1354 with KCI Technologies was executed in 2006 to continue the storm system inventory and inspection for the next five-year period with the following tasks:

- Develop priority inspection schedule for re-inspection of existing system
- New inspections in New Castle, Kent and Sussex Counties
- BMP inspections

Injunctive Relief

DelDOT has fulfilled its obligation under the Consent Decree to complete the I-95 Stormwater Project. Please see Annual Report 2001, Volume 3, Appendix U for a complete report and photographic documentation of the I-95 Additional Injunctive Relief Stormwater Controls. The components are identified below:

- Ditches – DelDOT replaced concrete channels with riprap at 18 locations and replaced 8 concrete ditches with vegetated ditches. DelDOT will provide maintenance of these ditches during the term of the Consent Decree.
- Shallow marshes – DelDOT designed and constructed two shallow marshes along I-95 as bioretention areas. DelDOT will provide maintenance of these ditches during the term of the Consent Decree.
- Stone check dams – DelDOT designed and constructed 7 stone check dams along I-95. DelDOT will perform regular inspections and maintenance during the term of the Consent Decree.
- Biofiltration swales – DelDOT has constructed biofiltration swales along I-95 as per the Consent Decree. DelDOT will conduct annual inspections and provide maintenance.

Pesticides, Herbicides and Fertilizers

Development of long-term pesticide reductions strategies:

1. Guardrail Inventory – identity guardrail areas where herbicide application can be reduced or eliminated
2. Guardrail Vegetation Management pilot study – test two types of weed block material, hand trimming and low-grow fescue to reduce or eliminate herbicide application
3. Median mowing height and Enhancing Delaware Highways native plants plot study – assess the water quality benefits of higher turf heights and EDH plantings.
4. Development of an Integrated Roadside Vegetation Management (IRVM) Manual for DelDOT
5. Improved contract language

6. Additional training
7. Improved record keeping

Illicit Discharge and Improper Disposal Program

DelDOT and NCCo. inspected all permit-covered outfalls during the five-year period of the permit (May 1, 2001 to April 30, 2006) for the presence of illicit connections and improper discharges. A total of 4,622 outfalls were inventoried in New Castle County. We use a numerical rating system for water quality parameters in dry weather flow, which provides an index that determines which outfalls are targeted for follow-up evaluation.

We contracted with KCI Technologies, Inc., to continue the dry weather screening for DelDOT-owned outfalls through 2009. Priorities in 2008 included:

- Making one final attempt to locate outfalls previously identified on maps by a prior consultant, but never verified
- Rescreening outfalls that previously had been found to have dry weather flow
- Inventory and screening of new outfalls
- Tracking and follow-up of reported or suspected incidents of illicit dumping into the storm sewer system

DelDOT also continued a public education program to help eliminate improper disposal and dumping into storm drains. Whenever evidence of improper dumping is discovered, either through routine inspections or citizen complaints, the entire community is canvassed with educational door hangers.

Sweeping Program

DelDOT is continuing its 4:2:1 frequency on primary, secondary, and tertiary roads. More frequent sweeping occurs on interstate highways. No new sweepers were purchased in 2008.

Snow and Ice Program

DelDOT has upgraded its existing fleet with ground speed spreader controls, plow balance valves and apply the techniques of anti-icing and pre-wetting in an effort to

reduce overall salt usage. New trucks will be fully equipped with ground speed spreader controls and plow balance valves.

Storm Event Monitoring Program

Wet weather monitoring at the five prescribed outfalls in New Castle County was temporarily suspended in 2006 after a memo requesting this change to our SWPP&MP was submitted to DNREC and approved. In late 2007, following meetings with EPA to discuss the results of our Phase I Permit audit, DelDOT and New Castle County jointly decided to reinstate the storm event monitoring program in order to complete the total number of events originally required by the permit and the consent decree. During 2008, Duffield Associates and KCI Technologies collected wet weather data from these outfalls.

BMP Monitoring Program

DelDOT has an extensive BMP performance monitoring and assessment program. KCI Technologies, Inc., was hired to perform the bulk of the field sampling and laboratory analysis for our program. This includes wet weather monitoring of stormwater outfalls and BMPs (both structural and nonstructural), as well as chemical and biological monitoring of streams that are impacted by stormwater discharges from DelDOT BMPs. In addition to the work performed by KCI Technologies, DelDOT has also partnered with DNREC and the University of Delaware on BMP monitoring projects.

During calendar year 2008, DelDOT's BMP monitoring program included the following projects:

1. Monitoring of BMP retrofits at the I-95 service plaza site, including comparison of the performance of various catch basin insert filters
2. Leatherman's Run stream assessment
3. Performance and maintenance study of Delaware sand filters
4. Study of a treatment train for vehicle washwater
5. Study of the impact of street sweeping on pollutant removal from parking lots
6. Study of guardrail vegetation control alternatives

7. Monitoring of BMP outfalls at DelDOT maintenance facilities

Retrofits

DelDOT initiated and/or completed the following stormwater retrofits in 2008:

1. Middletown maintenance facility: DelDOT submitted final plans, advertised the contract and selected a contractor to complete the work. We plan to construct two concrete pads for vehicle washing and brine mixing, retrofit the dry pond to a wet pond for added pollutant removal, create a swale from the storage shed to the stormwater pond and regrade an existing swale to reduce erosion. Construction cost estimate is $191,983.
2. Ham Run stream restoration: Restoration of 500 LF of stream using natural channel techniques, creating two wetland floodplains/stormwater wetlands and creating a filter strip. DelDOT's consultant will prepare final construction plans.
3. Blackbird Creek stream restoration: DelDOT is working with DNREC on this project and has agreed to prepare a conceptual design for restoration of 1,600 linear feet of a main tributary and three tributary branches to Blackbird Creek using natural channel techniques and creation of a wetland floodplain.

Construction Site Runoff

Section 110 of DelDOT's Standard Specification, Erosion, Sediment Control and Water Pollution was significantly rewritten to improve E & S inspections, reporting and compliance. A new Environmental Compliance Supervisor position was added to review CCR inspection reports and track compliance.

Public Education and Outreach

DelDOT's public education program includes the following accomplishments for calendar year 2008:

- Partnered with the Appoquinimink River Association for public education and outreach.
- "Clean Water Begins and Ends With You" drawing contest.

- DelDOT is continuing the “Door hanger campaign,” begun in 2006, as an educational tool to neighborhoods where illicit disposal are reported.
- DelDOT staff participated in the following public outreach events:
    - Delaware Rural Water Association – we exhibited our display board and graphics and touch screen stormwater slide show;
    - Technology Students Association – served as judges on environmental and engineering projects.
    - Delaware State Fair – we exhibited our display board and graphics and touch screen stormwater quiz.

Table A. FY09 NPDES Budget.

2009 Budget - Opertional Money

VENDOR	DESCRIPTION	
Beginning Balance	**NPDES**	**2,460,000.00**
Total Available		**2,460,000.00**
1. Phase I NPDES		
KCI	Storm Drain Inventory; start-up PO	**15,000.00**
	Agreement 1354; PO 309253	**789,824.08**
Subtotal		**804,824.08**
2. Storm System Maintenance		
North District		**0.00**
		0.00
Canal District		**0.00**
Central District		**0.00**
South District		**0.00**
Subtotal		**0.00**
3. Phase II NPDES		
URS		
Subtotal		**0.00**
4. Sweepers		
	Sweeping disposal assistance to North, Canal, & Central	**0.00**
Subtotal		**0.00**
5. Monitoring		
KCI	start-up PO	**15,000.00**
	Agr. 1351, water qualilty monitoring contract; **PO 309254**	**585,000.00**
WEF & ASCE	membership ($236.00 & $220.00)	**436.00**
Subtotal		**600,872.00**
6. Industrial Compliance and Permitting		
DNREC	NOIs	**3,200.00**
PIG	spill kits and decks	**8,000.00**
Subtotal		**11,200.00**

Table A. FY09 NPDES Budget.

2009 Budget - Opertional Money

VENDOR	DESCRIPTION	
7. Public Education		
Partnership	Agr. 1449; Education/Outreach (drawing contest; brochures; graphics design; etc.)	**5,000.00**
	Agr. 1483; drawing contest; PO xxxxxx	**30,000.00**
Appoquinimink River Association	Agr. 1478; public education/outreach; fertilizer education campaign	**10,000.00**
Graphics & Printing	activity booklets	**0.00**
	door hangers (1,000)	**500.00**
	calendars for 2008 contest	**7,500.00**
	tip cards; 13,000 for Partnership project in St. Jones	**943.21**
	paycheck stuffer (45,000)	**3,852.00**
2009 Harrington Fair		
Geiger	public outreach give aways	
MAE Group	public outreach give aways: T-shirts, staff shirts, etc. for Fair 2009, Coast Day and Earth Day	**12,000.00**
Harrington Fair	tickets	**100.00**
Harrington Fair	tickets	**80.00**
Office Depot	Fair supplies	**41.29**
Rain Barrels and More	rain barrel give-aways for BOW	**100.00**
DRWA	annual dues	**305.00**
Frank McShane	"DelDOT Working to Protect Delaware's Waterways" brochure	**220.00**
Delaware State News, Cape Gazette, Dover Post	Del. State News ($2,083.20); Dover Post ($782.00)	**2,865.20**
Clear Channel Broadcasting	stormwater quality commercials	**1,680.00**
WGMD-FM Radio	commercial	**880.50**
	banner stands	**3,000.00**
Subtotal		**79,067.20**
8. Staff Training		
CCR training	Modern Maturity Center fees	**4,600.00**
	printing manual	**2,312.66**
ASCE	membership fee	**220.00**
DWRA	conference fee	**250.00**
Water Environment Federation	dues	**175.00**
Whitman Requardt	E & S Control Field Guide; **Agreement 1480**	**40,000.00**
News Journal	advertisement for CE PM I postion	**701.20**
Delaware State News	advertisement for CE PM I postion	**389.65**
Subtotal		**48,648.51**

Table A. FY09 NPDES Budget.

2009 Budget - Opertional Money

VENDOR	DESCRIPTION	
9. Equipment		
	road sensors for North District	**86,000.00**
Office Depot	office equipment	**102.71**
	binders and tabs for CCR course	**408.12**
AGC of America	field manuals	**187.92**
Subtotal		**86,698.75**
10. Retrofits		
JMT	start-up PO	**15,000.00**
	Tasks 1 & 2; Agr. 1412; Retrofit design agreement for wash water and stormwater	**110,000.00**
	Task 3 (Ham Run; Blackbird Creek; Anchorage Canal; retrofit planning; Total Task 3 = $118,120.51	**118,120.51**
Suntree	replacement booms and units	**2,700.00**
Subtotal		**245,820.51**
11. Stormwater Ponds		
JCM Environmental	Agreement 1435; herbicide contract for stormwater ponds	**10,000.00**
Mumford & Miller	stormwater pond maintenance	**316,738.60**
	CE money	**35,000.00**
Subtotal		**361,738.60**
12. IRVM/Pesticide		
U of D	mowing height/EDH plot study	**13,800.00**
U of D	EDH	**99,014.00**
U of D	guardrail study - experimental research for weed block	**20,000.00**
		1,000.00
Wallace, Montgomery & Associates	guardrail inventory; Agr. 1438; start-up PO	**10,000.00**
		43,500.00
Subtotal		**187,314.00**
	Total expenses for Operational Money	**2,426,183.65**
	Difference	33,816.35
Beginning Balance	**NPDES Capital available**	**1,060,000.00**
	Middletown maintenance yard - Adel	191,983.00
	CE money	20,000.00
Daisy Construction	Cheswold construction, bid 269,972.7 + 5% contigency Contract 26-500-12; CE 020389	283,500.00
	Contigency increase	8,700.00
DMJM Harris	inspection for Cheswold orginally 15,947.26 moved some for contigency increase	7,247.26
Environmental Quality Resources	Sand filter contract; 28-500-06 EE = $142,491.00 + 5% contigency; bid price $100,235.50	100,235.50
RK&K	Harrington design; 28-035-01	100,000.00
	Walton, Agr 1394, soil borings	1,730.00
	Harrington construction	350,000.00
	wetland work	18,000.00
BrightFields	SPCC plans, Harrington and Magnolia; 28-035-02	10,000.00
	Magnolia wash pad	0.00
	South District wash pads	0.00
	Difference	**6,604.24**

Legend

Table B. Projection of Work to be performed during Calendar Year 2009.

Storm Drain Inventory and Inspection

- Inventory and inspect new systems in NCC.
- Re-inspect existing system in NCC based on priority maintenance schedule.
- Continue system inventory and inspection outside permitted boundaries in Kent and Sussex Counties.
- Continue statewide annual BMP inspections.
- Make modifications, as necessary, to the NPDES map viewer.

Monitoring

- Continue dry weather screening of New Castle County outfalls.
- Continue wet weather monitoring of New Castle County outfalls.
- Continue sand filter maintenance study.
- Continue study of guardrail vegetation management alternatives.
- Continue semiannual monitoring of stormwater discharges at DelDOT maintenance yards.
- Conclude BMP performance monitoring at the I-95 service plaza.
- Initiate study of the impact of different mowing strategies on water quality.
- Redirect monitoring efforts toward evaluation of "green" technologies.

Pesticide, Herbicide and Fertilizer Program

- Complete draft of Integrated Roadside Vegetation Management manual – two-part manual for establishment and maintenance of vegetation with IRVM goals of reducing the application of pesticide, herbicide and fertilizer.
- Guardrail Inventory - The inventory and attributes collected will be used in development of a pesticide reduction strategy.
- Guardrail Research project with University of Delaware – research pilot study to test several treatments under guardrail in development of a pesticide reduction strategy.
- Purchase spill-decks for pesticide storage.
- Purchase pesticide responder kits for spray vehicles.

Construction Site Erosion and Sediment Controls

- Implement revised Standard Specification 110, Erosion, Sediment Control and Water Pollution. Modifications to this section include:
    - Mandatory pre-construction meeting specifically to discuss E & S controls.
    - Contractor staff must provide CCR and must provide name(s) of CCR at the time of bid instead of after award.
    - Stronger actions to gain compliance.
    - Better details on division of responsibilities.

- Contractor responsible for fines if as a direct result of the contractor's refusal to implement and maintain the required erosion and sediment control, fails to supply a Site Reviewer, or fails to routinely perform E&S inspections, complete the E & S Reports and correct deficiencies identified in the E & S Reports.

Snow/Ice Program

- Utilize new technologies implemented in 2004:
  - Continue to retrofit existing trucks with new ground speed controls to reduce salt application.
  - Anti-icing application prior to snow/ice event to reduce overall salt application.
  - Pre-wetting salt with liquid de-icers to increase effectiveness of salt.
  - Continue to retrofit existing trucks with plow balance valves on snow plow blades to reduce road damage thereby reducing particles that can enter waterways.

Drainage Program

- Financially support Districts for repair and maintenance of the storm drain system in New Castle County.
- Continue to submit and repair work orders resulting from storm system inspections; consultant will prioritize work orders before submitting to Maximo.

Public Education, Outreach & Training

- Continue partnership with the Appoquinimink River Association in development of education and outreach programs.
- Participate in outreach events: Delaware Rural Water Association Conference and Delaware State Fair.

Staff training

- Develop and distribute stormwater pollution prevention bulletins to all DelDOT maintenance yards on a semi-annual basis.
- Continue requiring new DelDOT maintenance staff to view stormwater pollution videos.
- Require DelDOT staff to annually view Spill Prevention Control and Countermeasures (SPCC) videos.
- Conduct pesticide training.
- Train staff on the Establishment and Maintenance manual.
- Begin training DelDOT staff on the use of the NPDES stormwater system map viewer.

BMP Inventory and Inspection Program

- Inspect DelDOT owned BMPs; generate work orders as needed.
- NPDES staff will review work orders submitted by consultant and provide detailed instructions to the appropriate district to correct defect.

- Maintain stormwater ponds identified through annual inspection as needing erosion control or sediment removal.
- Award contract and begin work for stormwater pond maintenance.
- Treat noxious and invasive vegetation as needed using consultant services.

Retrofits

- Retrofit Middletown maintenance facility to address vehicle wash water issues to include stormwater pond rehabilitation, vegetative swales, check dams, and wash pads. A contractor has been selected and is scheduled to complete the retrofit by June 2009.
- Ham Run stream restoration: Prepare final construction plans.
- Blackbird Creek stream restoration: Prepare concept plan.
- JMT Engineering has been tasked with selecting, recommending and prioritizing BMP retrofit sites. They will review existing NPDES and other stormwater-related studies and prepare conceptual plans as necessary.
- JMT will assist DelDOT in development of their first Infrastructure Plan for a chosen watershed as required by the NPDES permit's Area-specific Storm Water Pollution Prevention and Management Program Requirements.

Maintenance Yards

- Review and update Pollution Prevention Plans (PPPs) and Spill Prevention Control and Countermeasures (SPCC) plans as necessary.
- Continue quarterly and annual inspections.

SWPP&MP Assessment

This section is an annual review of the current SWPP&MP. Program elements included here describe substantive program improvements, successful programs and recommendations for discontinuing or modifying less than successful programs.

DelDOT Work Orders on the Storm Sewer System

DelDOT's inspection consultants are required to report deficient components of the storm sewer system and enter them into our work order system, Maximo. When this project began we erred towards reporting any defect regardless of severity. As a result, the Districts received thousands of work orders that were very low priority, had no immediate effect on functionality or water quality and given the limited resources, remained as an unapproved work order in Maximo for years. As a result of lessons learned KCI is preparing a presentation that describes a range of system maintenance deficiencies for the Districts to review. The goal is to have both the consultant and the Districts submitting consistent, credible work orders.

Best Management Practices (BMPs)

BMP Inspections

DelDOT and KCI Technologies reviewed the current protocols for inspection, generation of maintenance work orders and vegetation control for our BMPs. To that end, KCI drafted a manual (Best Management Practices Field Inspection Manual) that improves upon the existing method of inspecting, collecting data and ranking and issuing work orders. We have already used the manual to identify stormwater ponds in need of maintenance and advertised a contract for repair. To achieve better consistency with work order rankings, we plan to meet with the Districts and present deficiency scenarios of the storm sewer system and come to a consensus. This will result in more accurate, efficient and credible work order submittals than in the past.

Assessment of BMP Performance

DelDOT's NPDES Section has continued its substantial and successful stormwater and BMP performance monitoring program. The budget for the program has grown since 2002 from $50,000 to $600,000 per year. We have tested multiple treatment technologies and used the

results of our studies to guide decisions of Department engineers in choosing BMPs for retrofits and new construction. As noted in the SWPP&MP Assessment section of our 2007 Annual Report, we felt a need to submit our performance data to the International BMP Database so that DOTs and other agencies around the country could make use of it. In 2008, we tasked KCI Technologies with submitting all data that meet the database's criteria. We have found that providing all of the design data required by the BMP database is challenging in some cases, because as-built plans are not always available. We anticipate completing data submission for the performance monitoring conducted at the I-95 service plaza sometime in 2009.

Our BMP demonstration and testing project at the I-95 service plaza has been a particularly successful effort and is coming to a close as redevelopment of that site approaches in 2009. An important component of this project was the inclusion of a comprehensive, long-term stream assessment, which has allowed us to evaluate directly the impact of stormwater discharges and BMP treatments upon the health of the Leatherman's Run watershed. We have accumulated six years worth of semi-annual monitoring data from the stream system and used the data to compile recommendations for retrofit and restoration projects in the watershed. At the end of calendar year 2008, we made the decision to suspend the extensive stream monitoring, feeling that we have sufficient data for this system and that the substantial funds devoted to this can be better directed to new monitoring efforts. However, we still felt that some monitoring in the stream near the service plaza would be useful, particularly during construction of the new site. Therefore, we are in the process of purchasing and installing two YSI EcoNet Data Acquisition Systems immediately upstream and downstream of the service plaza site. These systems will provide continuous in-stream monitoring data for turbidity, conductivity, pH and dissolved oxygen.

As the service plaza project concludes, we have been assessing what DelDOT's most important BMP performance data needs are. In this assessment we have taken into consideration factors such as: (1) where important data gaps exist; (2) what data are needed in order to assess progress towards compliance with anticipated future requirements to meet TMDL waste load allocations; and (3) what data may have greatest impact upon DelDOT operations vis-à-vis meeting water quality standards. Thus we feel that future monitoring efforts should include the following priorities:

- An important piece of information required to calculate BMP pollutant load reductions is drainage area. We are in the process of obtaining these data through review of stormwater reports. New two-foot LIDAR contour data are to be released for New Castle County in 2009, and these data will also be used as necessary to delineate BMP drainage areas and storm sewersheds. This will assist us in performing calculations needed to assess progress toward meeting Waste Load Allocations specified in TMDLs.
- More focus will be placed on obtaining pollutant removal data for "green" BMP technologies such as bioswales, grassed filter strips, and bioretention cells. DelDOT designs are including more of these types of BMPs, and water quality data for these are more limited than for ponds and manufactured BMPs.
- Budget limitations and water quality considerations have led DelDOT to review its mowing and vegetation management policies. A monitoring project to assess the water quality impacts of differing vegetation management strategies, including native plantings and reduced mowing, will be commenced in 2009.

Pesticide, Herbicide, Fertilizer

DelDOT's Roadside Environmental section manages PHF applications applied by contractors and DelDOT staff. The NPDES Program has the responsibility to develop programs and implement controls through training, policy changes resulting from research, development of SOPs, education, etc. to reduce the pollutants associated with their application and to track trends that can document anomalous spikes in usage or declines in usage due to implementation of programs.

Following the 2006 audit, the NPDES Section took the opportunity to meet with Roadside Environmental staff to improve upon our PHF reduction program. We have implemented several pesticide reduction programs as described below:

1. Guardrail pilot study – DelDOT currently treats approximately 280 miles of guardrail with herbicide. We developed a program in conjunction with the University of Delaware to investigate methods to reduce the use rates of pesticides and carriers used to treat guardrail vegetation without compromising safety and aesthetics. We

selected and applied treatments to compare the effectiveness, ease of implementation, aesthetics, cost and longevity. Treatments included weed control barriers, low-growing vegetation and cutting existing vegetation. Herbicides will be used on treatment plots as a measure against non-chemical treatments. The study, begun in 2008, will continue to be monitored throughout the 2009 growing season.

2. Guardrail inventory – Treating guardrail accounts for a significant percentage of DelDOT's herbicide treatment program. The NPDES Program saw guardrails as a relatively simple way to reduce herbicide usage. This project's objectives are to inventory all guardrails statewide and collect attribute data that includes material under guardrail and surrounding landscape and environmental features. With this information we can determine a course of action to apply the treatment methods, in lieu of or to reduce herbicide, as described in the guardrail pilot study and identify "no-spray" zones.
3. Establishment and Management Manual – DelDOT currently has a "Concept and Planning Manual," developed in part to promote integration of vegetation management in the planning, design and construction phases of highway development. DelDOT hired the University of Delaware to develop an Establishment and Management Manual. The E & M Manual follows Integrated Roadside Vegetation Management (IRVM) principles and explains in detail the necessary steps to establish sustainable roadside vegetation, and manage that vegetation in an environmentally sound, aesthetically pleasing, and fiscally responsible manner. Incorporating IRVM principles is as way for DelDOT to reduce herbicide usage and encourage native vegetation planting. DelDOT staff will be trained on the use of the manual.
4. Herbicide SOP – The Roadside Environmental Section is preparing a herbicide standard operating procedure to be used by DelDOT and contractor staff that includes the following objectives:
    - To ensure the appropriate and effective application of herbicides as a management tool
    - To ensure the safety of all individuals participating in the use of herbicides
    - To use herbicides only when they contribute to the perpetuation of species, communities, and ecosystems targeted for preservation or when they provide the most efficient and/or environmentally compatible method in the following

situations: (1) maintain traffic line of sight, (2) treat noxious species legally requiring control and (3) protection and maintenance of assets.
- Minimize the detrimental effects to the environment

5. Contract language – New language was added to all contracts that specify using EPA-approved drift control agents and only using formulations of glyphosate with a full aquatic label to eliminate any confusion on when and where to use aquatic labeled glyphosate.
6. Mowing Standard Operating Procedure – The NPDES Section conducted a study to determine the impact that grass length has on stormwater runoff quality. Overall, the study showed a water quality improvement in reducing the amount of sediment released and associated metals and that the higher grass releases road salt more slowly. To that end, the Roadside Environmental Section has begun revising the mowing policy last written in 1984. Improvements will include:
    - Maintain utility turf at a height of 6 inches. Utility turf constitutes the majority of mowed areas.
    - Mow one mower width on either edge when median is greater than 40-feet wide, leaving a "beauty strip" along the edge. The unmowed portion will act as a filter to improve water quality.
    - Maintain a 10-foot buffer around stormwater ponds; mow biofiltration swales to a 6" height minimum.
7. Training – We have increased our mandatory training for DelDOT staff. DelDOT's Environmental Roadside Section held a "Basic Herbicide Application" training workshop for 25 DelDOT employees
8. Pesticide efficacy – We purposely choose low toxicity herbicides to treat the noxious and invasive species within stormwater BMPs. The most effective herbicides were not used if there were more environmentally compatible herbicides that still provided acceptable control of the target invasive vegetation species. Herbicide selection criteria used included:

- Minimal chemical residual "half-life."
- Limited or no soil mobility.
- Selective to the targeted vegetation species, when possible, resulting in use of a broad-leaf selective herbicide to control Canada thistle that will not adversely impact vegetation other than broad-leaf plant species.
- Use of only aquatic labeled herbicides, including for upland Canada thistle control due to the potential for drift into nearby associated aquatic BMPs.

Since we selected low toxicity herbicides, we made qualitative observations of pesticide efficacy. Results indicated effective control of treated invasive vegetation was achieved. For a full report on our invasive species control on stormwater BMPs, see Appendix 1A.

9. Record keeping – The NPDES Program has begun tracking and reporting herbicide quantities to establish baseline herbicide usage (Table 5-1). By tracking herbicide quantities we hope to be able to identify the cause of spikes or declines in usage and use the data to assess pesticide reduction programs we have implemented.

Construction Site Runoff

Erosion and sediment control at DelDOT construction sites falls under the purview of the Division of Transportation Solutions (DOTS). However, the NPDES Program, through its permit and consent decree, is responsible for ensuring E & S control compliance. As a result of the 2006 NPDES audit, EPA's general findings listed several areas within construction site programs that needed improvement requiring: (1) appropriate education and training for construction site operators, (2) conducting weekly inspections and enforcing regulations if violations are not addressed promptly, and (3) tracking compliance rates to identify any improvements resulting from training. To that end, the NPDES Program staff assessed the E & S program and worked with DOTS to work towards programmatic changes. We convened several meetings with construction administrators to make significant improvements to their program listed below:

1. The first step to improving compliance with E & S regulations was to make revisions to the Standard Specification110, Erosion and Sediment Control and Water Pollution. The major changes to Spec 110 are listed below:
    - Previously, DelDOT was responsible for all CCR (Certified Construction Reviewer) inspections. This responsibility fell on one individual employee due to limited staffing. It was often difficult to conduct the required weekly inspections. We now require the contractor to provide a CCR and must submit the name at the time of bid and must conduct E & S reviews jointly with a member of DelDOT's construction on-site staff. This results in better record keeping.

- It is standard procedure to conduct a pre-construction meeting on new projects. The dominate topic is typically construction related and E & S was often perfunctory. We now require a pre-construction meeting specifically designed to address E & S compliance.
- We now have a better defined division of responsibilities among site reviewers, contractor engineer, project engineer, stormwater engineer so that all parties are aware of their responsibilities which leaves less chance of omissions due to unawareness.
- Strengthening of actions to gain compliance: Spec 110 now states that if the contractor fails to perform the work as directed by the engineer, the engineer can take "…..*any or all*" actions ranging from limited suspension of activity to default of contract. Any fines levied against the Department due to E & S non-compliance by the contractor, the contractor will be responsible for payment.
- DelDOT provided Certified Construction Reviewer (CCR) training to 59 staff conducting E & S inspections, designing stormwater systems, review of stormwater plans and/or anyone involved in earth disturbing activities.

2. Soon after the 2006 audit, DelDOT added a new position to oversee DelDOT's E & S Program. The Environmental Compliance Supervisor shall regularly track and review the construction site reviews submitted on a weekly basis from NOI to NOT. The major duties are to:
   - Act as a liaison between contractor and DelDOT CCR to ensure compliance with E & S regulations.
   - Document that the required weekly CCR reports are completed, track the project from NOI to NOT, track and review the construction site inspection reports, and annually assess CCR's performance. The addition of this position has resulted in better reporting in terms of compliance, record keeping and timely submittals. This tracking will be assessed to document improvements in CCR reporting due to improvement in Spec. 110 and more oversight by Environmental Compliance Supervisor.

- Conduct performance reviews of contractor CCRs (Figure A). If necessary, a CCR who is not timely remediating the deficiencies noted on the inspection report, he/she can be replaced. These reports are forwarded to DNREC.
- Hold non-compliance meetings with DNREC: When the contractor repeatedly refuses to comply with and address deficiencies noted on the inspection report, the Environmental Compliance Supervisor requests a non-compliance meeting with DNREC for possible enforcement action.

Public Education

The NPDES Section contracts with several non-profit organizations to assist with development of education and outreach programs. The Partnership for the Delaware Estuary, the Appoquinimink River Association and the Delaware Nature Society has specialties in watershed and water quality education. Partnering with these organizations has proven to an effective means of expanding our limited staff resources in a cost effective manner. One of our more popular programs is the annual "Clean Water Begins and Ends with You!" drawing contest. Participation has grown from less than 300 in 2003 to over 1,200 in 2007.

Part of our public outreach effort is participating in public events. The biggest event each year is the Delaware State Fair where we participate for 10 days. We developed an interactive touch screen water quality game that tracks the number of times the game is played. Each participant receives a high-quality prize that displays our stormwater website. We assessed the pre- and post event number of site visits and found no difference concluding that the free giveaways had no impact on increasing public interest in visiting our website. Although we feel there is a benefit of the face-to-face interaction, we will consider reducing the quality and quantity of prizes as a cost saving measure.

Wet and dry weather screening

In 2006, DelDOT and New Castle County requested that the storm event monitoring that was conducted at the five prescribed outfall locations be discontinued until a clearly defined use of the data was outlined. Instead, we suggested that our wet weather monitoring efforts be focused instead on assessment of retrofits and BMP performance. Future wet weather

monitoring would be revised to target TMDL compliance, according to the requirements as specified in our new MS4 permit when it is issued. DNREC agreed to our request to suspend wet weather monitoring until the requirements under the new permit were clarified. In accordance with our agreement with DNREC, additional funding was directed to our BMP performance monitoring program.

Following the EPA audit of the permit in 2006 and 2007, the storm event monitoring program was reinstated in order to complete collection of the total number of events specified in the original permit. We still feel that the program needs revision, but with the expected issuance of a new Phase I permit soon, we will wait for further guidance from EPA and DNREC on this. In the meantime, DelDOT and New Castle County decided to split the wet weather monitoring between two consulting firms – Duffield Associates and KCI Technologies – in hopes of completing this monitoring requirement as quickly and efficiently as possible.

Responsibility for dry weather screening of DelDOT-owned outfalls was transferred from New Castle County's consultant, Duffield Associates, to our own monitoring consultant, KCI Technologies, in mid-2006. Because of our closer contact with KCI, we have had better follow-up on potential illicit discharge investigations since this transfer. Our door-hanger campaign in communities with reported or suspected illicit discharges or dumping into storm drains continues to be an especially successful public education tool. We have received multiple calls for information each time we have distributed the door hangers.

Delaware Department of Transportation
Division of Transportation Solutions
Certified Construction Site Reviewer Evaluation

Date: 12/22/08

CCR Name: [redacted] CCR #: [redacted]

Employer: [redacted] Co.

[redacted]

[redacted]

DelDOT Project: South Governors Avenue Contract No.: 20-045-02

Contractor: [redacted] Co. Area Eng.: Jonathan Ledger

☒ Pre-Con Attendance CD

_____ Submitted Reports (Due 7 days) Y N Accurate Reporting

Good Rain Event Reporting **Was replaced 11/10/08.**

Communication: 1 2 3
(1= below average, 2 = average, 3 = above average)

Overall Performance*: 1 2 3
(1= below average, 2 = average, 3 = above average)

Comments: (1) [redacted] is the second CCR assigned to this project. Report period was from mid-August to November 2008. Reporting was well below average and reflected contractor progress rather than addressing deficiencies. CCR problems were addressed in monthly progress meetings twice. At one point the CCR requested a copy of a correctly filled out report for reference, which was provided.

☒ Attached documentation

Comments Continued.

(2) Site conditions were not being accurately reported

and by November, the Department requested a new CCR be assigned from the contractor

staff.

(3) Attached are 2 reports, one from the CCR and the submitted 4 days after from DelDOT.

(4) BMPs were not constructed to Standard Details and/or Standard Specification. BMPs

were not maintained, deficiencies unnoted.

(4) Contractor replaced the CCR as of 11/10/08.

*Overall Performance is based on the reporting of accurate information regarding the project BMPs (maintenance, construction, and implementation).

Figure A. CCR Performance Evaluation.

1. MS4 Structural Controls

Requirement:

DelDOT shall operate and maintain the MS4 and any structural controls incorporated into the system to reduce the discharge of pollutants (including floatables) to the maximum extent practicable as described in the Application page iv-6, Part 5 (iv) A1, Permit page 5, Part II.A.1. and Consent Decree page 11, Part II 17.

Performance:

Stormwater Conveyance Systems

The NPDES Section uses consultant services to inventory and inspect the entire DelDOT-owned system. From these inspections, work orders are generated for repair or maintenance. DelDOT uses in-house forces and contractors to maintain its stormwater conveyance system.

Drainage Maintenance Contracts

DelDOT uses district maintenance personnel and contractors to maintain the stormwater conveyance system in New Castle County. This work insures the proper operation of the stormwater system and will reduce the pollutants that are carried to waterways. Each of the two districts in NCCo., North and Canal, has its own drainage contract with an annual budget of $1 million.

This work has three components, (1) open system drainage, (2) closed system drainage, and (3) ponding problems. The open drainage system represents general work to control erosion and cleaning and reshaping of ditches. The stabilization of ditches reduces the amount of sediment that enters the local stream and waterways. Closed drainage represents the underground system that includes pipes, manholes, inlets, catch basins and outfalls. Drainage problems reported by citizen complaints are also programmed into the drainage contract.

Stormwater Pond Contracts

The NPDES Program contributed an additional $300,000 to the North District drainage contract to repair and maintain seven dry stormwater ponds, mostly clearing and grubbing. We also executed a $316,000 contract to conduct more major repairs on stormwater management facilities to include sediment excavation, slope stabilization, forebay and check dam construction, etc. Work on this contract will begin in 2009.

Storm Sewer System Inventory and Inspection

DelDOT executed Agreement #1354 with KCI Technologies on November 29, 2006 for a five year term to continue the inventory and inspection program begun in 2001. All respective parts of the stormwater conveyance system will be inventoried on a five or ten-year cycle based priority schedule. This prioritization schedule is based on a final recommendations report developed by DelDOT and URS Corporation that determine appropriate inspection frequencies for purposes of long term monitoring (See Annual Report 2006, Volume 2 of 2, Appendix C). This work includes: drainage inlets, manholes, associated piping, stream channels, ditches, pipes and storm drains, and identifying which drainage inlets function as catch basins. Catch basin, as defined in the Consent Decree, is a special type of drainage inlet that provides water quality treatment. As part of this contract, a comprehensive GIS database was developed that enables users to view the entire stormwater system, corresponding inspection data and pictures (See Annual Report 2003, Volume 2 of 2, Section 1, Figure 1-1).

The following bulleted list describes the current status of the agreement up to and including calendar year 2008:

- Total of 6,086 storm system structures inspected.
- KCI completed the annual inspection of all BMPs
- Completed Version 1 of the NPDES map viewer

Please refer to Appendix A for a summary report prepared by KCI Technologies on the Storm Drain Inventory/Inspection Project.

Work Orders

Work orders are generated when DelDOT staff or their consultant determines if repair or maintenance is required. A work order is created and entered into Maximo, DelDOT's work order database. They are ranked on scale of 1-5 depending on the severity of the problem. Maintenance supervisors then review and determine if the work order will be completed by DelDOT personnel or contractors. The NPDES section and the Districts will meet with KCI in early 2009 to develop consistency in ranking.

B. Stormwater Collection and Conveyance Complaint System

The Governors Surface Water Task Force recommended that an assistance program be created to aid each individual with his/her unique drainage or stormwater issue. Once an individual's information has been logged into the system the concern will automatically be

forwarded to the proper agency. This program has a telephone number and email address to allow individuals to express their concerns (see Annual Report 2007, Figure 1-1). This provides one central point of contact when seeking solutions to the public's concerns.

When a complaint is called directly into DelDOT, information is gathered that includes location, problem, caller's name and phone number, etc. Once the information is documented, a work order request is generated and entered into DelDOT's Maximo database system. The complaint is investigated and the Operations Supervisor determines what type of repair, if any, is necessary. The work is assigned to the appropriate Maintenance District for repair. If no work is needed (no problem found during investigation) a courtesy call is returned to the complainant and the results of the investigation are explained.

C. Maintenance Inspection of Completed Stormwater Facilities

DelDOT has an annual requirement to inspect its constructed best management practice (BMP) devices, structures and stormwater management facilities. The purpose of this statewide program is to: (1) inventory, inspect, measure water quality performance, identify noxious and/or invasive species and maintain functionality of DelDOT's stormwater BMPs such as stormwater ponds, sand filters, bioinfiltration trenches, etc., (2) maintain a comprehensive database, (3) coordinate with the Districts on the submittal of work orders as needed, and (4) provide technical assistance and guidance to the Department regarding appropriate maintenance strategies for stormwater BMPs.

A field inspection manual and forms were developed to effectively perform field inspections to evaluate BMP performance and to identify maintenance requirements. The procedures outlined in this manual will assist DelDOT with decisions on inspection, maintenance, repair, and retrofit of BMP facilities. Appendix B provides a list of constructed and proposed BMPs in New Castle County. KCI inspected 294 BMPs statewide in 2008.

Maintenance functions are performed by the Districts or through contractors specializing in noxious and invasive species control or maintenance of specific BMP types such as StormFilter® and BaySaver®. We executed a three year agreement with JCM Environmental to control noxious and invasive species. DelDOT, through its contractor, performed clearing and grubbing on seven dry stormwater ponds. Additionally, DelDOT has identified wet stormwater

ponds in need of more major maintenance. A contract has been executed and the work is scheduled to begin in spring 2009.

D. BMP Performance Monitoring and Assessment

The NPDES permit requires DelDOT to monitor the performance of existing stormwater structural controls and BMPs. During calendar year 2008, DelDOT's BMP monitoring program included the following projects:

1. Monitoring of BMP retrofits at the I-95 service plaza site, including comparison of the performance of various catch basin insert filters
2. Leatherman's Run stream assessment
3. Performance and maintenance study of Delaware sand filters
4. Study of a treatment train for vehicle washwater
5. Study of the impact of sweeping on removal of pollutants from parking lots
6. Study of guardrail vegetation control alternatives
7. Monitoring of BMP outfalls at DelDOT maintenance facilities

See Section 13 ("Monitoring") and Section 16 ("Pollution Prevention at the Maintenance Facilities") of this report for a full description of each of these projects and monitoring results.

E. Bridge Maintenance

DelDOT's Bridge Division is federally mandated and follows the Code of Federal Regulations (23 CFR 650.3). DelDOT normally inspects bridges every 24 months or less depending on condition. If a bridge is in a degraded condition, inspection will occur more frequently. Inspectors use a "Structure Inventory and Appraisal Sheet" (see Annual Report 2001, Volume 3, Appendix D) found in the "Recording and Coding Guide for the Structure, Inventory and Appraisal of the Nation's Bridges." The structural integrity of the bridge is evaluated on a scale of 0-9, where a score of 0 describes a failed condition. If repairs are necessary a report is sent to the appropriate Maintenance District where a work order is generated for the repair. Channel and Channel Protection is Item #61 on DelDOT's "Structure Inventory and Appraisal Sheet". This item describes the physical conditions associated with flow of water through the bridge such as stream stability and the condition of the channel, riprap, slope protection, etc. The inspector assesses visible signs of excessive water velocity that may

affect undermining of slope protection, erosion of banks, and realignment of the stream. Accumulation of drift and debris on the superstructure and substructure is noted on the appraisal sheet. Item 61 is coded on a scale of 0 to 9. Coding of zero means that the bridge is closed due to channel failure and code 9 means that there are no noticeable deficiencies that affect the condition of the channel. Stream channels are inspected when the bridges are inspected at the same two- year interval. In 2008, DelDOT inspected 755 bridges.

2. New Development and Significant Redevelopment

Requirement: DelDOT shall utilize a comprehensive master planning process to develop, implement, and enforce controls to reduce the discharge of pollutants from areas of new development and significant redevelopment. DelDOT shall review watershed assessment reports, relevant wasteload allocations, Total Maximum Daily Load (TMDL), or Pollution Control Strategies and develop a schedule for maintenance or retrofit of structural controls. DelDOT shall assess the water quality impacts of its existing and ongoing development planning activities. DelDOT shall construct and implement BMPs necessary to protect water quality. Additionally, DelDOT shall budget at least $150,000 per year for storm water management retrofit projects as described in the Application page iv-15, Part 5 (iv) A2, Permit page 7, Part II.A.2. and Consent Decree page 16, Part II 18.

Performance:

A. *Assessment and Planning*

- DelDOT has adopted Mobility Friendly Design Standards (see Annual Report 2001, Volume 3, Appendix F) for subdivision and minor collector Subdivision Street. These standards, among other things, are roadway design standards that promote low-impact development strategies such as landscaped areas and narrower pavement widths that support the Statewide Long Range Transportation Plan.
- DelDOT's Planning Section considers water quality when it completes a Categorical Exclusion Evaluation (CEE) report when reviewing new projects.
- DelDOT is a delegated agency under DNREC's State of Delaware Erosion and Sediment Control Program for land disturbance greater than 5000 sq. ft.
- DelDOT's Subdivision Manual regulates development in Delaware that will be turned over for State Maintenance. Before a subdivision is accepted, a DelDOT Inspector inspects the structural integrity of the stormwater system and the pipes are scoped using Closed Circuit Television. If defects are discovered the contractor is responsible for repairs. This ensures the structure is free of defects, joints are watertight, pipes are sediment free, etc.
- Advancements in technology have aided DelDOT's snow fighting practices. Improvements were initiated that achieve DelDOT's objectives of increasing our level of service, establishing more cost effective and efficient practices, and reducing the impact on the

environment and infrastructure. Snow and ice removal strategies include ground speed spreader controls, anti-icing, pre-wetting, brine production, and plow balance valves. Reduction in overall salt usage is a benefit resulting from these new strategies.

- As part of Enhancing Delaware Highways, DelDOT has reduced mowing along roadsides. This has several positive effects: reduction of grass clipping entering the storm drain; filtering of stormwater from roadways before it enters the storm drain; aesthetic enhancement; reduced maintenance hazards; and diverts budget resources for higher priority needs. Additionally, DelDOT is developing a mowing Standard Operating Procedure to be completed by spring 2008. Some of the main actions to be implemented are:
    - Mowers set to a height to 6"; this height has been shown through our research to have water quality benefits
    - Leaving 10-foot buffer strip around stormwater ponds
    - Rear-discharge mower rotary mowers
    - Medians > 40' are mowed with a "beauty strip" leaving the center median uncut
    - Regular cleaning of mowers to reduce spread of invasive plant parts, insects and disease
- DelDOT is in the process of developing a two-part Establishment and Maintenance manual. The Manual explains in detail the necessary steps to establish sustainable roadside vegetation, and manage that vegetation in an environmentally sound, aesthetically pleasing, and fiscally responsible manner. The second part of the manual, Managing Vegetation, describes strategies to minimize the use of pesticides and develop alternative control methods as specified by the NPDES permit. The final draft will be completed in spring 2009.

B. Retrofit

Per the Consent Decree, DelDOT is required to budget $150,000 per year for stormwater retrofits. In calendar year 2008, DelDOT expended $167,965.61 towards its NPDES retrofit program. Table 2-1 summarizes total costs incurred for design and construction of retrofits from 2001 – 2008. This total amounts to $2,164,220.62.

JMT Engineering, the NPDES design consultant, worked on several projects in 2008:

Middletown maintenance facility - completed the design for Middletown maintenance facility. Improvements include adding a forebay to the existing dry pond, creating bioswales, and concrete wash pads. The project is scheduled to be advertised in January 2009

Ham Run - This project consists of restoring approximately 500 LF of stream using natural channel techniques, creating two wetland floodplains/stormwater wetlands and creating a filter strip along Duncan Road prior to draining into the relocated stream. Included in the channel restoration is realignment of the channel within the property owned by DelDOT so as to provide a better approach alignment into the existing culvert under Greenbank Road.

Blackbird Creek - The project consists of preparing a conceptual design for restoration of a main tributary and three (3) tributary branches to Blackbird Creek using natural channel techniques and creation of a wetland floodplain.

Table 2-1. Cost Summary for DelDOT Retrofits, 2001 – 2008.

Project Design/Construction	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Retrofit Design Cost	$ 82,000.00	$1,775.00	$ 86,315.00	$ 51,510.00	$104,000.00	$ 97,481.47	$ 27,253.18	$ 167,965.61
SR 273/SR7 Park & Ride sandfilter	$ 90,000.00							
I-95 Service Plaza construction:								
- Bioretention/Sandfilter/Stormfilter				$411,000.00				
- Baysaver					$165,000.00			
Storm drain inserts			$ 33,000.00	$ 90,000.00	$ 20,024.00			
Appoquinimink River retrofit inventory				$ 10,000.00				
Bear maintenance facility construction						$531,702.14		
Leatherman's Run retrofit planning			$ 5,792.33	$ 32,798.45	$ 52,838.63	$ 48,952.93	$ 54,811.88	
TOTAL COST	$172,000.00	$1,775.00	$125,107.33	$595,308.45	$341,862.63	$678,136.54	$ 82,065.06	$ 167,965.61

3. Roadways

Requirement: DelDOT shall operate and maintain public streets, roads, and highways, in such a manner as to reduce, to the maximum extent practicable, the discharge of pollutants as described in the Application page iv-30, Part 5(iv) A3, Permit page 7, Part II.A.5. and Consent Decree page 18, Part II 19.

Performance:

The following programs described below are ways the Department manages and minimizes transport of pollutants associated with road repair and maintenance activities:

A. Road Repair and Maintenance

There are various ways in which the Department maintains the roadways that help reduce the discharge of pollutants. Routine maintenance and improvements reduce the pollutants coming from the roadway in several ways. The patching of potholes and sealing of cracks reduces the amount of pavement that will break away and be transported into the nearest waterway. Repairing potholes will also decrease the wear and tear on vehicles, thus reducing the fluids, miscellaneous sediments, and tire particles that could be dislodged from vehicles.

DelDOT has a Standard Operating Procedure developed for responding and managing spills on the roadways classified as **Category E, Type E-1** incidents (Traffic Hazards, Fuel, Oil or other HAZMAT spills on or near the roadway). Most DelDOT vehicles have been equipped with spill kits in the event of an accidental spill or as a first responder to a vehicle accident; employees have been trained how to respond to spills and protection of water quality.

All road projects are required to follow the Delaware Sediment and Stormwater Regulations. Projects designated as minor, medium or major shall have an approved sediment and stormwater management plan. Medium and major projects must also have a site reviewer who is a Certified Construction Reviewer (CCR).

B. Sweeping Program

DelDOT's sweeping program reduces pollutants by maintaining the cleanliness of the roadway. The street sweeping program includes the roadways, shoulder, intersections, and toll plaza lanes on primary, secondary and tertiary roads. The roadways are swept on the following cycle: roads with ADT (Average Daily Traffic) greater than 20,000 are swept 4 times a year,

roads with ADT between 5,000 and 20,000 are swept 2 times a year and roads with ADT less than 5,000 are swept once a year.

The current fleet of sweepers in New Castle County consists of 9 mechanical sweepers and 11 regenerative air vacuum sweepers.

C. Litter Control Programs

DelDOT maintenance staff and prison crews

DelDOT's maintenance staff and prison crews help reduce the discharge of floatables to the MS4 through routine pick up of trash and debris from the roadways and medians and right-of-way. DelDOT staff is also responsible for removal of dead animals and clean up of illegal dump sites from the roadside.

Adopt-a-Highway

Adopt-a-Highway is a cooperative program between DelDOT's Division of Public Relations and volunteers to reduce litter along State roadways and subsequent discharge to waters of the State. This program supplements effort by DelDOT's maintenance forces to control litter. The volunteer groups are required to collect litter a minimum of twice per year and submit activity reports following each cleanup for inclusion in the program. Each group maintains approximately two miles of roadway. DelDOT maintains an Adopt-a-Highway website (www.deldot.gov) and submits press releases to solicit volunteers. There are currently over 800 volunteer groups in New Castle County maintaining over 1,600 lane miles.

Anti-Litter Campaign

The Division of Motor Vehicle offices offered free car litter bags to all motorists. DelDOT is also bringing the anti-litter message to young people by partnering with school districts. Another partnership with the Department of Natural Resources and Environmental Control resulted in the fines to at least four persons who littered along a DelDOT roadway. The NPDES Program also submitted anti-litter quarter-page newspaper advertisements to the Delaware State News (Figure 3-1).

Roadside Clean-up

DelDOT held its fourth annual "Imagine a Litter Free Delaware" cleanup day along roads, highways and community areas in September 2008.

D. Snow and Ice Program

Effective salt management practices can help reduce the amount of road salt that enters the environment. This translates into savings for DelDOT, protection against liability, and minimization of impacts of salt on our environment. DelDOT has many practices in place, both for the roadway and all maintenance facilities.

DelDOT has developed and instituted advanced snow fighting practices that began during the 2004-2005 winter season to include ground speed spreader controls, anti-icing, pre-wetting, and plow balance valves. These advanced techniques in snow and ice removal help DelDOT meet its goal of improved service to customers, reduce the impact to the infrastructure, and conserve salt which helps meet the goals of the NPDES Program by reducing the impact on the environment:

- Ground speed spreader controls provide accurate control of material usage.
- Anti-icing is the application of liquid deicers (Salt Brine) to road surfaces prior to a precipitation event to prevent the formation or development of bonded snow and ice. The Department presently has eleven units of 1300-gallon capacity and six units of 1800-gallon capacity that slide into the bed of a dump truck. We are in the process of retrofitting (4) 5000-gallon tanker trailers equipped with spraying capabilities to be pulled by the Departments current fleet of truck tractors.
- Pre-wetting adds moisture to salt to “jump start” the melting action of the salt and causes the salt to stick to the road and prevent scatter or bouncing.
- Plow balance valves decreases the amount of weight that the plow cutting edge bears on the road surface decreasing damage to the road surface.

Salt application rates can vary depending on storm conditions, but the goal is 100 - 400 pounds of salt per lane mile as recommended by AASHTO. The rate is achieved by calibrating the equipment annually and sending maintenance personnel to a one-day seminar provided by The Salt Institute. The seminar instructs on proper salt application procedures and quantities balanced with safety and environment.

All salt stored at the maintenance facilities is under roof. Only during loading and unloading does the potential exist for salt to enter the stormwater system. DelDOT is following the salt management practices established by the “Statewide Salt Best Management Practices for

DelDOT Maintenance Yards" plan developed two years ago (see Annual Report 2004, Appendix U).

Figure 3-1. Anti-litter newspaper advertisement.

4. Flood Management

Requirement: DelDOT shall assess and minimize to the maximum extent practicable, the impacts of any flood control projects on receiving water quality as describe in the Application page iv-38, Part 5(iv) A4, Permit page 7, Part II.A.4. and Consent Decree page 19, Part II 20.

Performance: DelDOT does not have a regional flood control program and does not undertake flood control projects. DelDOT's only responsibility is maintenance of existing tide gates and mill pond outfalls. Should DelDOT become involved in any flood control project in the future, consideration will be given to incorporating water quality control measures.

5. Pesticides, Herbicides and Fertilizers

Requirement: DelDOT shall implement controls to reduce, to the maximum extent practicable, the discharge of pollutants related to the application of pesticides, herbicides, and fertilizers by the co-permittee's employees or contractors to public rights of way, parks, and other municipal property or facilities. In addition, the co-permittees shall implement programs to encourage reductions in the discharge of pollutants associated with the commercial application and distribution of pesticides, herbicides and fertilizers as described in the Application page iv-45, Part 5(iv) A6, Permit page 7, Part IIA.5. and Consent Decree page 19, Part II 21.

Performance:

All herbicide applications that are applied to DelDOT rights-of-way by contract applicators are reviewed prior to the award to the lowest bidder to insure that selected herbicides are labeled for the intended use, and that when feasible, a herbicide is selected that can be applied at a low-use rate. This review frequently reduces the total load of herbicide applied to DelDOT's rights-of-way.

DelDOT does not routinely fertilize its roadsides. The only nutrients applied to DelDOT's rights-of-way come as a result of leaving grass clippings on the ground after mowing. Degradation of this vegetative material results in the slow release of organic constituents that are mineralized to plant nutrients by microorganisms and subsequently available to turfgrasses. This natural process results in minimal leaching of nutrients. Also this practice results in minimal surface runoff of nutrients from ground with a slope of 3 horizontal to 1 vertical or less.

Fertilizers are used in establishing turfgrasses from seed on freshly prepared bareground. This is generally done under contract with a firm using a hydroseeder. DelDOT's specifications require that 50% of the nitrogen product be a slow release form of ureaformaldehyde. The amount of nitrogen applied is 78 kg/ha. Phosphorous pentoxide is applied at 47 kg/ha of available P that is the sum of water soluble and citrate-soluble phosphate. Potassium oxide is applied at 31kg/ha of water soluble potash. In all cases areas that are seeded are covered with a recommended mulch.

Pesticides applied on DelDOT's rights-of-way are done according to label recommendations that are on the product and filed with EPA at the time of product registration. Pesticides applied on DelDOT's rights-of-way are done by contractors that are certified Delaware pesticide applicators. DelDOT employees that apply pesticides to DelDOT's rights-of-way are certified Delaware pesticide applicators or work under the supervision of a DelDOT employee that is a certified Delaware pesticide applicator. Typically, the only pesticides applied by DelDOT fall under the category of herbicides. DelDOT, however, may use other pesticides such as insecticides under certain circumstances.

DelDOT employees take required training courses that serve as credit toward renewal of their Delaware pesticide applicators license. Roadside Environmental Specialists attend conferences and working sessions on pest control technologies that are open to all DOT employees. Opportunities to use reduced amount of pesticides by using new low rate pesticides, adjuvants or surfactants that can enhance efficacy of pesticides and thus reduce rate, or alternatives to chemicals that are cost effective and efficacious are often topics of various sessions these specialists attend.

We began implementing several programmatic initiatives as part of the NPDES pesticide reduction strategy:

1. Guardrail Inventory – DelDOT has the responsibility of maintaining a 4' clear zone around the guardrail for both public safety and structural integrity via mowing, hand trimming and herbicides. The guardrail inventory is a field inventory and database project. The inventory and attributes collected will be used in development of a pesticide reduction strategy to limit the use of herbicides, particularly around environmental sensitive areas (e.g. streams, wetlands, drinking supply, etc.). Each DelDOT-owned guardrail section will be GPS'd and attributes collected. Attributes include material under guardrail, guardrail type, surrounding environmental features and identification of sensitive/no spray zones. We executed an agreement with Wallace Montgomery & Associates, LLP in May 2008. As of December 2008, they are approximately 80% complete, inventory 250 guardrail miles.

2. Guardrail Vegetation Management pilot study – DelDOT and the University of Delaware developed a controlled research study to test the effectiveness of treatment types under guardrail for weed control. Two types of weed block material, asphalt, and natural growth with periodic trimming will be monitored against a control. The results of this study will determine if these materials are effective at reducing herbicide application and can be used in specific locations such as environmental sensitive areas and drinking water supply reservoirs. A detailed summary report is found in Section 13-C6 of this report.
3. "Establishment and Maintenance" manual – DelDOT has contracted with The University of Delaware to develop an "Establishment and Management" manual to manage vegetation along Delaware's highways. One goal of the manual is developing pesticide reductions strategies that follow Integrated Roadside Vegetation Management (IRVM) objectives. The first draft was reviewed in January 2008. The manual is expected to be complete by March 2009. The University of Delaware will conduct training workshops on the E&M manual for district staff statewide.
4. Contract language – Since DelDOT outsources most of the herbicide spraying, DelDOT has strengthened its herbicide contract language to reduce the environmental impact of herbicide treatment. We now require contractors to:
    a. Use an EPA-approved drift control agent as part of the mix
    b. Use only formulations of glyphosate with a full aquatic label.
    c. Be aware of the locations of "Sensitive" or "No spray" zones and avoid applications within the limits of these areas. These zones will be identified through the guardrail inventory and made available to the contractor.
5. Training – In addition to the required training for pesticide license renewal, DelDOT holds additional periodic training to further educate staff. In August 2008, we held a basic pesticide training workshop for 21 staff.
6. Record keeping and pesticide usage – Contractors and DelDOT applicators are required to submit records of spraying activities to DelDOT's Environmental Roadside Section. The NPDES Program has begun tracking and reporting

herbicide quantities to establish baseline herbicide usage. (Table 5-1). By tracking herbicide quantities we hope to be able to identify the cause of spikes or declines in usage and use the data to assess pesticide reduction programs we have implemented.

Table 5-1. 2008 Contractor Herbicide Spray Totals for New Castle County.

2008 Brush Spraying Totals – New Castle County

Chemicals (Gallons); * denotes pounds

Garlon 3A	Tordon 101	Escort*	Krenite	Thinvert	Arsenal	Milestone	Surfac 820
6.0	7.5	1.4	64	64	2	0.75	6.0

2008 Guardrail, Islands, Signposts Spraying Totals – New Castle County

Chemicals (Gallons); * denotes pounds

Karmex*	Aquacap	Tordon 101	Journey	Accord	Competitor	Sahara*	Bullseye	Surf 820
1,781.8	127.9	63.6	126.1	105.4	126.1	504.2	16.9	1.1

2008 BMP Spraying Totals – New Castle County

Chemicals (Gallons)

Garlon 3A	Rodeo	Habitat	LI 700	Cygnet Plus	MSO
5.34	6.80	0.11	0.89	3.22	0.08

6. Illicit Discharge and Improper Disposal

Requirement: The co-permittee's shall: (1) implement a facility inspection program (*New Castle County only*), (2) implement an on-going program to detect illicit discharges and improper disposal into the storm sewer, (3) implement procedures to limit infiltration of seepage from sanitary sewers, and (4) implement a public education program on proper management and disposal of an array of organic and inorganic materials. These requirements are described in the Application page iv –30, Part 5(iv) A6, Permit page 7, Part II.A.5., Consent Decree page 19, Part II 22.

Performance: Until June 30, 2006, DelDOT partnered with New Castle County (NCC) to conduct wet and dry weather monitoring as per the Interjurisdictional Agreement (see Annual Report 2001, Volume 3, Appendix I). The co-permittees were required to inspect all permit-covered outfalls in NCC during the first five-year period of the permit (May 1, 2001 to April 30, 2006) for the presence of illicit connections and improper discharges. This work was completed by Duffield Associates. Starting July 2006, DelDOT took over responsibility for the illicit discharge detection and elimination (IDDE) program only within the DelDOT-owned portion of the stormwater conveyance system. Similarly, New Castle County manages their IDDE program that includes outfalls of their ownership. DelDOT has contracted with KCI Technologies, Inc. (under Agreement No. 1351) to perform the dry weather screening for DelDOT-owned outfalls through 2009.

DelDOT has the responsibility of eliminating illicit connections to the MS4. DelDOT first tries to effect these eliminations through administrative action. KCI is instructed to send the potential violator a "Notice of Potential Illicit Discharge" letter. The letter describes the illicit discharge and instructs the resident to eliminate the discharge within 30 days. A follow-up inspection is conducted after the 30-day period. If the illicit discharge is still present, DelDOT's NPDES Section will send a second letter stating if the discharge/illegal connection has not been eliminated/removed after the 30-day period, the enforcement branch of the Department of Natural Resources and Environmental Control (DNREC) will be notified. If that is unsuccessful, we can use police action through DNREC. DelDOT established a Memorandum of Agreement

on August 20, 2001 with DNREC to utilize Environmental Protection Officers in the enforcement of the permit. A copy of the MOA was included in Annual Report 2001.

In 2008, nine Potential Illicit Discharges (PIDs) were investigated, as summarized in Table 6-1. Each of the PIDs listed in Table 6-1 is described in more detail below. Additional information regarding the PIDs is provided in Appendix C. The nine PID investigations resulted from the following:

- Three PIDs - Outfalls 318, 2542, 2543 – discovered by KCI field crews performing outfall screening of outfalls with previous dry weather flow.
- Two PIDs: - 4662 Forrest Ave. and 91 Limerick Lare Rd - discovered by Century Engineering (CEI) while completing MS4 inventory and inspections in Kent County.
- Four PIDs - referred to KCI personnel by DelDOT and New Castle County personnel.

Table 6-1. 2008 Potential Illicit Discharge Investigations.

Date	County	Address	Type Waste	Determination
02-27-08 *	New Castle	B&O Lane in front Euro-Tech Auto Garage	Discharge tested high for pH/detergents/turbidity; strong petroleum odor and visible oil sheen.	Non-DelDOT (Referred to NCCo)
04-08-08	Kent	91 Limerick Lare Rd	Other(Sludge) dumped into catch basin	Distributed Door Hangers
05-15-08	New Castle	32 Dynasty Dr (Mansion Farms)	Cooking grease in catch basin	Distributed Door Hangers
06-09-08 *	New Castle	Lea Blvd.	Discharge test high for detergents and ammonia; sewage odor and visible toilet paper around outfall	Non-DelDOT (Referred to NCCo)
06-09-08 *	New Castle	Lea Blvd.	Discharge high for detergents; sewage odor and visible toilet paper around outfall	Non-DelDOT Referred to NCCo
08-26-08	New Castle	Summit Pond	Dog Waste/Yard Clippings found in catch basin	No Action/No Signs of dumping
09-15-08	New Castle	Troy Avenue (Woodcrest)	Visible oil running down driveway	Distributed Door Hangers
09-22-08 * 11-11-08	Kent	4662 Forest Avenue	Discharge tested high for ammonia, detergents and phenols	Pipe from washing machine re-routed to septic tank
11-12-08	New Castle	900 Hazeldell Ave	Oil/Antifreeze draining into catch basin	Distributed Door Hanger

7. Spill Prevention and Response

Requirement: DelDOT shall implement a program to prevent, contain, and respond to spills that may discharge into the MS4 as described in the Application page iv-59, Part 5(iv) B2, Permit page 9, Part II.A.7., Consent Decree page 20, Part II 23.

Performance:

DelDOT's Transportation Management Center (TMC) is a department wide facility that coordinates operations and shares information among its own personnel as well as various other transportation and public safety-related agencies, serving as the transportation interface among all such agencies in the state. They operate 24-hours per day/7 days per week. They serve as the central communication point for DelDOT during major incidents, special events, and emergencies, and coordinates transportation management activities with other agencies. The TMC has special instrumentation that has been used to develop incident management capability.

The type of incident detected or called in will have a direct effect on the notification process and steps that must be taken in order to be able to respond, assist, and document the incident in an expeditious manner. Incidents have been classified into one of seven categories, and then into sub-categories that further specify the type of incident that has occurred. These categories are listed below:

Category A: Accidents (Emergency)

Category B: Vehicle Fire (Emergency)

Category C: Disable Vehicles (Emergency)

Category D: Police Activity (Emergency)

Category E: Traffic Hazards (Emergency)

Category F: Roadway and Signal Operations (Traffic)

Category G: Delay or Congestion (Traffic)

In June 2001, the TMC developed a manual of Standard Operating Procedures (SOP) that acts as a guideline for handling incidents and systems problems; as a training tool/resource for new employees and as a reference guide for the operations staff. *Category E: Traffic Hazards (Emergency)*, of the SOP describes the notification and documentation procedure involving fuel, oil or other HAZMAT spills on or near the roadway (see Annual Report 2001, Volume 3, Appendix J).

In the event of a spill such as fuel, oil, or HAZ-MAT, the TMC is required to notify the respective police agency since they are responsible for arranging for the particular traffic hazard to be removed. Generally, the police will contact the following agencies: Fire Board, DNREC (Department of Natural Resources and Environmental Control), tow company, and all other agencies that are required to attend such incidents.

In the event of a non-hazardous materials spill DelDOT mobilizes, responds and directs the clean up effort to prevent the material from entering the storm drain system or receiving waters. DelDOT purchased 450 vehicle spill kits for minor oil and/or pesticide spills. If the spill is of questionable material, DelDOT uses procedures as describe for HAZ-MAT spills.

In addition to the TMC's Standard Operating Procedures, the NPDES Program has completed the Spill Prevention Control and Countermeasures Plans for DelDOT facilities that met the above ground storage tank minimums. These plans bring DelDOT into compliance with EPA's Oil Pollution Prevention regulations (40 CFR Part 112) contained within the Clean Water Act. In 2007 two additional facilities, Harrington and Cheswold, met the minimum storage capacity due to the purchase of above ground storage tanks. We contracted with Brightfields Inc. to develop SPCC plans for these sites. These plans were completed in 2008.

During our annual inspections of the maintenance facilities, we determine if additional spill decks, kits or other spill prevention equipment or supplies are needed. The NPDES section funds these purchases.

We completed an agreement with CSERT (The Center for Emergency Response Training, Inc.) to develop three videos: (1) *SPCC Regulatory Requirements* - acquaints DelDOT personnel with the regulatory requirements of the Spill Prevention Control and Countermeasures (SPCC) plan, NPDES Permit program and other regulatory initiatives in designated DelDOT facilities; (2) *Spill Response & Emergency Procedures* and *Roadside Events* - trains DelDOT employees on the proper procedures for responding to facility and non-facility (roadway) based emergency events. Videos have been distributed to each maintenance facility and personnel are required to view annually.

8. Industrial and High Risk Runoff

This section pertains to New Castle County only. See Section 8 of New Castle County's annual report for details.

9. Construction Site Runoff

Requirement: DelDOT shall implement a program to reduce, to the maximum extent practicable, the discharge of pollutants from construction sites. DelDOT shall continue to administer a sediment and erosion control program in accordance with Delaware's Sediment and Storm Water Regulations and to notify applicable construction contractors of the NPDES requirements. DelDOT shall continue to implement a program to inspect construction projects for compliance with Delaware's Sediment and Storm Water Regulations and where applicable, requirements of the MS4 NPDES permit as described in the Application page iv-72, Part (iv) D, Permit page 10, Part II.A.9. and Consent Decree page 23, Part II 27.

Performance:

In Delaware, construction site runoff is controlled under State law, which has been in effect since 1990. The State Law (7 Del. C., ch. 40) meets or exceeds the requirements of the NPDES MS4 permit. The erosion and sediment control and stormwater management programs of DelDOT are managed by the Division of Transportation Solutions (DOTS). This program was delegated to DelDOT in 1991 by the Department of Natural Resources and Environmental Control (DNREC) and was to implement three of the five components of the Delaware Sediment and Stormwater Regulations (see Annual Report 2001, Volume 3, Appendix K). These components are review and approval of construction plans, review of construction sites, and inspection and maintenance of completed stormwater management facilities. Inspection and maintenance of completed stormwater management facilities is covered in section 1. MS4 Structural Controls. The delegation is reviewed every three years. The latest delegation was renewed effective July 2006 through June 2009. NPDES Program staff works with DOTS to ensure NPDES permit compliance.

Enforcement of construction site erosion and sediment controls is accomplished through each construction contract. Section 110 of the Delaware Department of Transportation Standard Specifications lays out a progressive step-wise approach to gaining compliance with approved plans, regulations, and laws. This section was significantly rewritten to demonstrate positive movement toward improving the Erosion & Sediment Program (see Annual Report 2007, Appendix D). The following items summarize the major changes:

1. Contractor required to provide CCR and must submit name at the time of bid and must conduct E & S reviews jointly with a member of DelDOT's construction staff.
2. Required pre-construction meeting specifically designed to address E & S compliance.
3. Better defined division of responsibilities among site reviewers, contractor engineer, project engineer, stormwater engineer
4. Strengthening of actions to gain compliance
5. Environmental Compliance Supervisor – new position at DelDOT to regularly track and review the construction site reviews submitted on a weekly basis from Notice of Intent (NOI) to Notice of Termination (NOT) and annually assess CCR's performance.

Additional/improved training on Clean Water Act, pollution prevention using common sense tactics, reporting, communication, posting NOI & Permits, etc. is being provided. A Certified Construction Reviewer (CCR) course was held in October 2008, where 59 DelDOT staff involved with erosion and sediment issues, E & S inspections, utility work, designing stormwater systems or review of stormwater plans attended.

10. Total Maximum Daily Load (TMDL)

Requirement: DelDOT shall comply with any MS4 NPDES permit requirement developed in accordance with relevant wasteload allocation contained in any final TMDL or, as applicable, with any Pollution Control Strategy developed to implement that TMDL as described in the Consent Decree page 24, Part II 28.

Performance:

Table 10-1 identifies the approved TMDLs in New Castle County that specify waste load allocations (WLAs) for MS4 discharges.

DelDOT staff have participated in the meetings of most of the Tributary Action Teams (TATs) that have convened throughout the state to develop Pollution Control Strategies (PCSs) for watersheds with approved TMDLs. These have included the Nanticoke River, Murderkill River, Inland Bays, Appoquinimink River, Broadkill River, St. Jones River, Christina River and Chesapeake Bay Basin watersheds. DelDOT staff have contributed technical expertise to these panels and considered the effect of TMDL implementation on DelDOT projects. With the exception of the Christina River and Chesapeake Basin watersheds, all of the TATs have submitted recommended PCSs to DNREC. Only the Inland Bays PCS has been approved and enacted into law. To date, no PCS has been approved for any receiving stream in New Castle County.

DelDOT has an active BMP performance and assessment program that is described in detail in Section 13 of this report. One of the objectives of this program is to provide data on the effectiveness of the BMPs under study in reducing pollutants targeted by TMDLs adopted for Delaware watersheds. This will allow DelDOT to conduct an analysis of the existing BMPs being implemented and select the most appropriate supplemental BMPs, if necessary, to achieve the numeric WLAs. Both structural and non-structural BMPs, including new and innovative manufactured products, are included in our BMP performance studies (see Section 13).

DNREC is requiring green technologies (grassed swales, infiltration trenches, bioswales, etc.) to be considered for managing stormwater. If traditional methods are chosen to manage stormwater, contractors must demonstrate why green technologies will not work due to engineering or hardship reasons. DNREC is amending its sediment and stormwater regulations to promote the use of stormwater management techniques that are more efficient at reducing

nutrient loading and promote Green Technology or stormwater practices based on low impact development and conservation design. DelDOT will abide by any new regulations DNREC develops, including watershed Pollution Control Strategies. The DelDOT Stormwater Engineer has already begun to plan for future trainings to help design engineers meet the requirements of PCSs and TMDLs as they are approved and enforced throughout the state.

Table 10-1. List of New Castle County waterbodies with approved TMDLs and MS4 waste load allocations.

Waterbody with Approved TMDLs	Pollutants Addressed by Approved TMDL with MS4 WLA
Appoquinimink River	Total Nitrogen, Total Phosphorus, Bacteria
Army Creek	Total Nitrogen, Total Phosphorus, Bacteria
Blackbird Creek	Total Nitrogen, Total Phosphorus, Bacteria
Christina River Basin	Total Nitrogen, Total Phosphorus, Bacteria
Delaware River	PCBs in tidal portion
Dragon Run Creek	Total Nitrogen, Total Phosphorus, Bacteria
Naamans Creek	Total Nitrogen, Total Phosphorus, Bacteria
Red Lion Creek	Total Nitrogen, Total Phosphorus, Bacteria
Smyrna River	Total Nitrogen, Total Phosphorus, Bacteria
Shellpot Creek	Total Nitrogen, Total Phosphorus, Bacteria

11. Public Education

Requirement: DelDOT shall within six months of entry of the Decree, implement a program to promote, publicize, and facilitate public reporting of illicit discharges having negative impacts on water quality on the MS4 and the proper management of an array of organic and inorganic materials as described in the Application page iv-72, Part 5 (iv) B3, Permit page 11, Part II.A.10. and Consent Decree page 20, Part II 24.

Performance:

A public education program was developed within six months of the effective dates as outlined in the NPDES permit and consent decree. The following public education activities occurred during calendar year 2007:

- DelDOT initiated an agreement in October 2007 with the Partnership for the Delaware Estuary to provide services for education and outreach activities. They are charged with developing hands-on educational programming to engage the public in water quality protection activities including (1) a "Clean Water Begins and Ends With You" drawing contest, (2) Education/Outreach activities that may include Public Service Announcements, design and distribution of brochures, pet waste campaign, or other elements. During 2008, DelDOT and the Partnership held its fifth annual statewide drawing contest entitled "Clean Water Begins and Ends with You." An awards ceremony and dinner were held in April. The winners were recognized and awarded savings bonds and art supplies. Sixteen winners were selected and their drawings were developed into a calendar (Figure 11-1). First place winners drawings were displayed on the back of DART buses in Delaware (Figures 11-2a through 11-2d).
- We are continuing our door hanger campaign to residents in subdivisions where an illicit discharge or illegal dumping activity was discovered or reported as part of our outreach program to residents. The front side of the door hanger lists the date and type of pollutant found and what water body affected. On the back, the door hanger describes stormwater pollution and guidelines to reduce pollution at the home or workplace (see Annual Report 2007, Volume 2 of 2, Figure 11- 3). We distributed 86

door hangers in 2008. This program also helps meet the public education requirements of Part II.A.6. *Illicit Discharges and Improper Disposal* of the NPDES Permit.

- DelDOT distributed several hundred activity booklets to schools and the general public that highlight stormwater pollution, the water cycle and watersheds.
- DelDOT developed a new stormwater website (www.deldot.gov/stormwater). A "Report a Problem" link allows the public to email or call to report illegal discharges or dumping and stormwater maintenance problems. We are averaging about 1,250 visits per month.
- The NPDES Program submitted anti-litter quarter-page newspaper advertisements to the Delaware State News (Figure 3-1).
- We designed and distributed 40,400 water quality tip cards in state employee paychecks statewide (Figure 11-3).
- As part of the storm drain inventory and inspection (Section 1.A.), KCI Technologies is continuing to label each inlet with a storm drain marker that carries a water quality message.
- DelDOT partnered with the Appoquinimink River Association (ARA) to lead and execute an education and outreach program to provide information to the public on ways to reduce nonpoint source pollution. The ARA assisted DelDOT in developing a watershed presentation for schools and community groups. A follow-up survey will be given to participants to measure the effectiveness of the presentation. Additional work accomplished is documented in their 2008 annual progress report (Appendix D). DelDOT partnered with the Appoquinimink River Association (ARA) to lead and execute an education and outreach program to provide information to the public on ways to reduce nonpoint source pollution. As part of their scope of work, the ARA is assisting DelDOT in developing a watershed presentation for schools and community groups. A follow-up survey will be given to participants to measure the effectiveness of the presentation.

The NPDES Program has a 10’ display board and graphics as well as an interactive kiosk for use at outreach events. In 2008 we participated in the following events:

- Delaware Rural Water Association – NPDES staff participated in this 2-day event.
- Earth Day at Killens Pond State Park – NPDES staff participated in this 1-day event.
- Delaware State Fair – NPDES staff participated for 10 days and evenings.
- NPDES staff served as judges in the Technology Students Association (TSA) State Conference in April.

Figure 11-1. 2008 "Clean Water Begins and Ends with You!" drawing contest calendar winners.

Figure 11-1 (cont.). 2008 “Clean Water Begins and Ends with You!” drawing contest calendar winners.

Figure 11-2a. K – 2nd grade first place winner appearing on DART bus.

Figure 11-2b. 3rd – 5th grade first place winner appearing on DART bus.

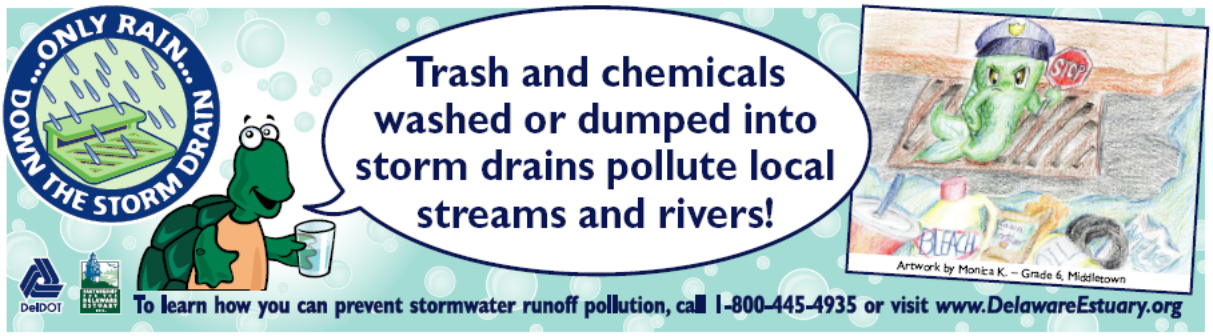

Figure 11-2c. 6th – 8th grade first place winner appearing on DART bus.

Figure 11-2d. 9th – 12th grade first place winner appearing on DART bus.

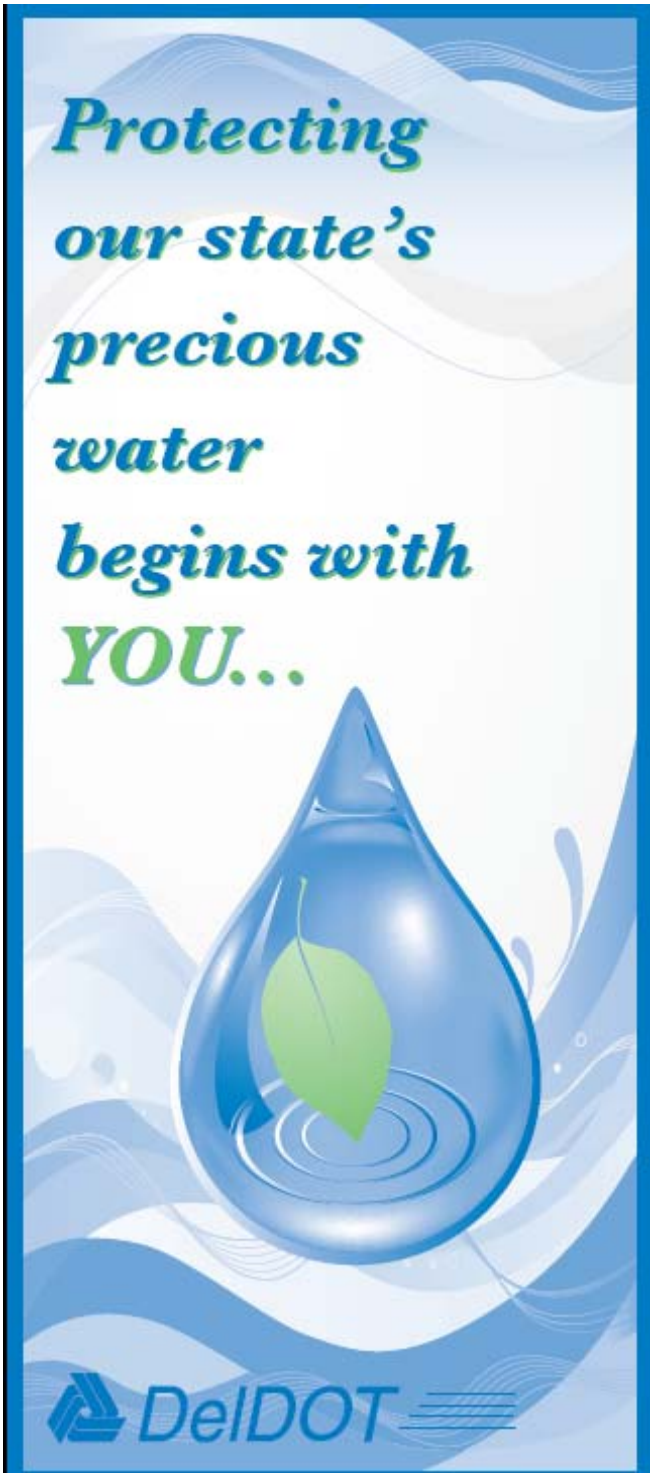

Figure 11-3. Pay check insert sent to all state employees.

12. Training

Requirement: DelDOT shall, within six months of entry of the Consent Decree, initiate training for their respective and appropriate personnel on storm water controls, on the storm water management measures established under the MS4 permit, and on specific requirements for implementing all relevant aspects of the Consent Decree as described on page 24, Part II 29 of the Consent Decree.

Performance:

The following is a list of training workshops and conferences attended by DelDOT staff and training material produced in calendar year 2008:

- All maintenance staff is required to view the following videos as part of Pollution Prevention Plans: Stormwater Contamination & Spill Prevention, Vegetative Control & Pollution Prevention, and Facility & Vehicle Maintenance.
- All maintenance staff is required to view videos as part of the Spill Prevention Control and Countermeasures Plans. The three topics include: SPCC regulatory requirements, spill response and emergency procedures and roadside events.
- NPDES staff are members of the Nonpoint Source Advisory Committee and attend the annual workshop.
- Winter Workshop – February 2008; attended by DelDOT staff and contractors. Mary Hamilton gave presentation on her role as Environmental Compliance Supervisor; training on erosion and sediment control, NPDES, seeding, soil retention blanket mulches and bonded fiber matrix.
- Public Workshop, February 13 and 20, 2008: Managing stormwater and properly maintaining stormwater systems. Participating organizations: DNREC, Sussex Conservation District, Center for Inland Bays.
- 25 DelDOT staff attended a “Basic Herbicide Training” workshop in August 2008.

- A Certified Construction Reviewer (CCR) course was held in October 2008, where 59 DelDOT staff involved with erosion and sediment issues, E & S inspections, utility work, designing stormwater systems or review of stormwater plans attended.
- Webcasts viewed by NPDES staff:
    - EPA webcast: BMP Performance
    - EPA webcast: The Art and Science of Stormwater Retrofits
    - EPA webcast: Assessing the Effectiveness of you Municipal Stormwater Program
    - EPA webcast: Using rain gardens to reduce runoff-slow it down, spread it out, soak it in!
- The DelDOT Stormwater Engineer and the NPDES Environmental Scientist attended the 2008 AASHTO/SCOE National Stormwater Conference
- The NPDES Environmental Scientist attended the EPA workshop, Water Quality Modeling to Support Management Actions, held in Baltimore, Maryland, September 9–10, 2008.
- The Roadside Environmental Section staff attended various courses and workshops for re-certification, pesticide credits, and ISA (International Society of Arboriculture) credits including:
    1. 2008 Delaware Nursery & Landscape Association Summer Expo
    2. 2008 Delaware Nursery & Landscape Association Winter Expo
    3. 2008 Delaware Ornamental & Turf Workshop
    4. Threats to Forest Health workshop
    5. 2008 Delaware Horticulture Industry Expo
    6. Ornamental Short Course Turf workshop
    7. 2008 National Roadside Vegetation Management Association conference
    8. DelDOT pesticide training workshop
    9. 2008 Invasive Species Workshop
    10. 2008 Mid-Atlantic Horticulture Short Course held in Virginia Beach, VA

13. Monitoring

Requirements: The co-permittees shall implement a wet weather and dry weather monitoring program, and an industrial and high-risk runoff monitoring program as described in the Permit page 11, Part II.A.11. and Consent Decree page 20, Part II 22b. DelDOT shall also monitor the performance of and discharge from existing structural controls (BMPs), in accordance with Permit page 6, Part II.A.1.a.

Performance:

During calendar year 2008, DelDOT's monitoring activities included the following components:

- Dry weather screening of stormwater outfalls
- Storm event monitoring (joint with New Castle County)
- BMP performance monitoring

Each of these components is described in more detail below.

A. Dry Weather Screening

In July 2006, DelDOT took over responsibility for illicit discharge detection and elimination (IDDE), including inventory of new outfalls and dry weather outfall screening, within the DelDOT-owned portion of the stormwater conveyance system. We contracted with KCI Technologies, Inc. (under Agreement No. 1351) to perform the dry weather screening for DelDOT-owned outfalls. Priorities for work in 2008 were to (1) attempt one final time to locate presumptive outfalls that were identified on early maps, but were never able to be field-verified by a previous consultant; (2) re-screen outfalls that previously had dry-weather flow; and (3) inventory and screen new outfalls that were not captured in the initial inventory.

The dry weather screening protocol was the same as that used in previous years. When dry weather flow is observed, a "Dry Weather Flow Evaluation" is performed in two stages: an initial screening at the time of first observation and a follow-up re-screening performed 4 to 24 hours later. Where appropriate, this includes flow rate estimation, field screening of discharge water quality using LaMotte stormwater sampling kits, and upstream visual review and evaluation. A numerical rating system for discharge water quality parameters provides an index that determines which outfalls are targeted for follow-up evaluation (Table 13-1).

Once an illicit discharge is confirmed, our consultant is responsible for tracking it to the source and taking the initial step in effecting its elimination. This may include: (1) referring it to the appropriate municipality; or (2) going to the source and informing the polluter verbally and in writing to remove the illicit connection with a time limit to comply. The consultant will conduct a follow-up investigation. If the connection is not removed, enforcement action can be initiated.

1. *Attempts to Locate Remaining Outfalls:* Part I of the 1995 Permit Application identified 3310 outfalls in NCC. Of these, 634 were designated as "major" outfalls. Duffield Associates held the original agreement with New Castle County and DelDOT to inventory and perform dry weather screening on all of these outfalls during the first five-year term of the Phase I Permit. Duffield Associates was never able to locate some of the major outfalls that appeared in the original map. When KCI Technologies took over responsibility for inventory and dry weather screening of DelDOT-owned outfalls, we tasked the firm to make one more attempt to locate and access the outfalls that Duffield was unable to find.

   In 2008 KCI attempted to locate a total of 150 of these outfalls in New Castle County. 26 outfalls were located and inventoried that were determined to be owned by DelDOT. KCI determined that as of now, a total of 5,905 outfalls in New Castle County fall under DelDOT's maintenance responsibility.

2. *Outfall Rescreening:* During the original dry-weather screening of New Castle County outfalls in the first Permit period, 509 outfalls were found to have dry weather flow. KCI Technologies was tasked to rescreen all of these that are DelDOT-owned during the three-year term of Agreement 1351. During calendar year 2008, 133 DelDOT-owned outfalls were rescreened (Table 13-2). The screening protocol identified three outfalls with potential illicit discharges, and these were investigated further. Detailed information on the resolution of these is provided in Section 6 of this report (Illicit Discharge and Improper Disposal).

3. *Inventory and Screening of New Outfalls*: During calendar year 2008, KCI inventoried 361 new outfalls (Table 13-2). All of these were in recently

constructed subdivisions. Two of the outfalls exhibited dry weather flow and were targeted by the rating system for follow-up. The flows in both cases were found to be due to groundwater intrusion.

B. Storm Event Monitoring

Wet weather storm event monitoring is specified in the New Castle County MS4 NPDES Permit Application and is required by the stormwater permit and consent decree. The wet weather monitoring program as originally established in 2001 was intended to identify, investigate and address selected water quality parameters of storm water runoff from five outfall locations identified in the Permit Application, representing four developed land use classifications.

Wet weather monitoring at the five prescribed outfalls in New Castle County was temporarily suspended after a memo requesting this change to our SWPP&MP was submitted to the DNREC Division of Water Resources in January 2006, and DNREC agreed to this request (see DelDOT 2006 Annual Report, Section 13). In late 2007, following meetings with EPA to discuss the results of our Phase I Permit audit, DelDOT and New Castle County jointly decided to reinstate the storm event monitoring program in order to complete the total number of events originally required by the permit and the consent decree. A decision was made to split this effort between two consultants: Duffield Associates (hired by New Castle County) and KCI Technologies (hired by DelDOT). A summary of the data from storm events monitored at these outfalls during 2008 is provided in New Castle County's 2008 Annual Report.

C. BMP Performance Monitoring and Assessment

The NPDES permit requires DelDOT to monitor the performance of existing stormwater structural controls and BMPs. During calendar year 2008, DelDOT's BMP monitoring program included the following projects:

1. Monitoring of BMP retrofits at the I-95 service plaza site, including comparison of the performance of various catch basin insert filters
2. Leatherman's Run stream assessment
3. Performance and maintenance study of Delaware sand filters

4. Study of a treatment train for vehicle washwater
5. Study of the impact of street sweeping on pollutant removal from parking lots
6. Study of guardrail vegetation control alternatives
7. Monitoring of BMP outfalls at DelDOT maintenance facilities

All tasks but the guardrail vegetation control study were conducted with assistance from KCI Technologies, Inc., under Agreement No. 1351. The scope of this agreement includes wet weather monitoring of stormwater outfalls and BMPs, chemical and biological monitoring of streams that are impacted by stormwater discharges from DelDOT BMPs, and dry weather screening of outfalls for illicit discharges into the DelDOT MS4. The total upset limit of Agreement 1351 is $1.8 million, with an annual budget of $600,000.

The study of guardrail vegetation management strategies is being performed by the University of Delaware, using funding contributed by the DelDOT NPDES Program. Total estimated funding for this project is $55,000.

Each of the different BMP monitoring projects is described below in greater detail.

1. *Monitoring of BMP Retrofits at the I-95 Service Plaza*

Over the past few years, five retrofit BMP projects were completed at the Interstate-95 Service Plaza in Newark, Delaware. These have been described in detail in previous annual reports. These retrofit projects include:

- A bioretention cell to replace concrete swales located between the southbound highway lanes and the plaza.
- A Delaware sand filter installed north of the service station at the east end of the service plaza.
- A StormFilter® vault installed south of the same service station.
- A BaySaver® device installed in the drainage area of the food service area of the plaza.

In addition, DelDOT has installed several types of storm drain inlet protectors at the service plaza over the past several years in order to test their effectiveness at removing pollutants from runoff from the service station and parking lot drainage areas. There are 60 drainage inlets at the site, and insert filters now protect all of them. All are

inspected monthly and maintained as needed. The types of units that are installed and under evaluation include:

- HydroKleen drain insert, which is a two-chambered unit consisting of a sedimentation chamber and a series of cellulose and activated charcoal filters;
- UltraDrainguard fabric inserts, made of a oleophilic geotextile material;
- Abtech Ultra-Urban Filter, containing Smart Sponge oil-absorbing and antibacterial filters. Two units were installed – one with Smart Sponge Plus (which has both oil-absorbing and antibacterial properties) and one with regular Smart Sponge material (which lacks the antibacterial additive).
- Suntree Grate Inlet Skimmer inserts. These have been installed in the drainage inlets in all of the DelDOT maintenance yards.

Individual catch basin insert units were modified so that samples of both influent runoff and treated effluent could be sampled directly in that catch basin. This modification involved configuring the units with stainless steel trays to capture effluent, including bypassed water, during a storm. Sampling tubes were added to draw water from this tray.

Baseline monitoring was conducted in 2003 and 2004 at the I-95 Service Plaza prior to installation of these water quality retrofits. These data were summarized in the 2004 DelDOT Annual Report. Long-term wet weather monitoring at these same points has continued following the retrofit constructions so that, over time, we can evaluate their overall effectiveness in reducing runoff pollution from the site.

Wet weather monitoring of each of the BMPs continued through calendar year 2008. Pollutant loads of influent and effluent stormwater flows from each BMP were evaluated to assess and compare the effectiveness of the BMP in removing stormwater contaminants. All sampling methodology was consistent with the EPA NPDES *Storm Water Sampling Guidance Document*, EPA 833-B-92-001. The protocol includes 72 hours of antecedent dry conditions and minimum predicted rainfall depth of 0.10 inches. Both first flush and 3-hour flow-weighted composites were collected. Samples were composited in the laboratory and analyzed for 29 different parameters by Atlantic Coast Laboratories in Newark, Delaware. After each storm event, the influent and effluent data

were used to calculate a percent mass removal for each parameter for each of the different BMPs. Box and whisker plots of the removal data have been prepared, and data are being submitted to the International BMP Database.

We had a goal of capturing a total of at least ten wet weather events for each BMP during the course of this project. The I-95 service plaza is slated for redevelopment in 2009, at which time the entire site will be redesigned. The new design will include a completely new storm sewer system and BMPs. Fortunately we were able to complete the ten wet weather events for all BMPs by the time of the writing of this report (March 2009). Thus the data collection phase of the project is complete. Calendar year 2009 will be devoted to data analysis, submission of results to the International BMP Database, and completion of a project final report.

Table 13-3 lists the storm events that were captured for each BMP in 2008, as well as the total number of storms sampled since each was constructed. Appendix E also provides 2008 rainfall data for comparison.

For a number of reasons, use of percent removal to assess BMP performance has recently been discouraged (e.g., J. Jones et al., guest editorial, Stormwater, January/February 2008). Therefore, we have organized all composite data collected for each BMP through 2008 into box and whisker plots, according to the recommendations of the International Stormwater BMP Database (www.bmpdatabase.org). In descriptive statistics, a box and whisker plot is a convenient way graphically to depict groups of numerical data through their five-number summaries (the smallest observation, lower quartile, median, upper quartile, and largest observation). These plots are useful in displaying differences between populations without making any assumptions about the underlying statistical distribution. The spacing between the different parts of the box helps to indicate the degree of dispersion and skewness in the data and to identify outliers.

Appendix F contains the box and whisker plots that summarize all of the BMP performance data collected at the I-95 service plaza through 2008. The plots compare all of the different BMPs, organized by parameter. As in previous years of BMP monitoring, we have observed a high degree of variability in data values between storm events. We have not yet completed statistical tests of significance on the BMP

performance data. However, an examination of the box and whisker plots does reveal some general trends.

When median removal rates are compared, the Delaware sand filter has shown good overall performance. The sand filter had relatively high median removal rates, compared to other BMPs, for suspended solids (75%), BOD (56%), and petroleum hydrocarbons (43%). The catch basin inserts, as a group, also performed relatively well for certain constituents, including TSS (21-63% median removal), petroleum hydrocarbons (20-30% removal). Interestingly, the Suntree catch basin inserts, which have an oil-absorbing boom collar, rather than an oil-absorbing filtration system like the other inserts, did not perform nearly as well as the other inserts in removing oils and petroleum hydrocarbons from runoff. The Suntrees did well, however, in removing suspended solids.

None of the BMPs performed particularly well in removing dissolved constituents or nutrients. Overall, the bioretention cell performed best in removing nutrients, but the rates were still rather low. Bacteria data were highly variable, and more detailed analysis is required in order to make any conclusions.

We intend to complete a final project report that will include statistical analyses of all of the BMP performance data from this project during 2009. KCI Technologies has also begun to submit all of the project data to the BMP Database. We hope to complete this as well in 2009.

DelDOT's BMP performance evaluation project at the service plaza was featured in an article entitled, "Test-Driving Stormwater BMPs," published in the April 2008 issue of Water, Environment and Technology. A copy of the article is included in this report as Appendix G.

2. Leatherman's Run Stream Assessment Project

Since 2003 we have conducted a long-term stream condition assessment and biomonitoring study on Leatherman's Run, the stream to which all of the stormwater from the I-95 service plaza is discharged. The objectives of this stream assessment project are: (1) to determine the impact on Leatherman's Run of stormwater discharges from DelDOT-owned facilities and drainage systems, particularly the I-95 service plaza;

(2) to determine locations for future retrofit projects that will have maximum impact in improving the condition of the stream; (3) to determine strategies for addressing the Christina Basin TMDL; and (4) to track improvements in stream quality associated with BMP retrofits implemented by DelDOT.

Analysis of the Leatherman's Run watershed began with a stream assessment in December of 2003. The stream continues to be monitored twice a year, once in the spring and once in the fall. The sixth year of monitoring was conducted in May and November 2008. A summary of the methodologies and results of data collected in 2008 at the monitoring stations is presented here.

Monitoring included water quality sampling (instream and laboratory-analyzed baseflow grabs), biological assessment (macroinvertebrate and fish collection), physical habitat assessment and geomorphic monitoring. The sixth year of monitoring in the Spring and Fall of 2008 was conducted at the same locations established in previous years. Spring water quality and biological sampling was conducted on May 23, 2008. Fall water quality and biological sampling was conducted on November 18 and 21, 2008 and the geomorphic assessments were conducted on October 30 and 31, 2008.

Of the instream parameters, pH, temperature, dissolved oxygen and turbidity have regulated criteria. All of these parameters except for the turbidity at Station ST4, in the fall, were within acceptable levels. Based on baseflow grab sampling, there appears to be a higher level of total dissolved solids and chloride for those stations downstream of the I-95 service plaza, continuing a trend from Year 4. Fecal coliform levels were elevated at most sites, and *Enterococcus* levels were also high. Other parameters of significance include phosphorus, zinc and cadmium, which were never detected in previous samples but were detected at all four sampling sites in 2007 and 2008.

Based on the 2008 sampling, there were no major changes evident in the biological community. As in 2006, all sites were classified as Not Supporting an acceptable level of biological health, with Station ST3 as an exception with Partially Supporting levels. The findings of the 2008 fish sampling are consistent with findings from 2003 – 2007. All three fish samples collected in 2008 decreased in diversity when compared to 2007 samples, with one or two species dominating. They also consistently had low numbers of intolerant species and high percentages of tolerant species, indicating

a reduction in water quality or habitat that is precluding sensitive species. Little to no change has been seen in the physical habitat and geomorphic assessment results since the baseline conditions were collected. All monitoring sites have the same Rapid Bioassessment Protocol (RBP) habitat rating seen in prior years, with the exception of Station ST4, which had an RBP of Not Supporting for the first time during this study. Geomorphic assessment results show slight erosion and aggradation of stream channels at the monitoring locations.

Methodologies and results of the two monitoring events that took place in 2008 are explained in detail in the "Leatherman's Run Stream Assessment: Year Six - 2008" report, which is included here as Appendix H.

With service plaza redevelopment slated to begin in 2009, we decided to suspend watershed-wide monitoring, at least temporarily. We felt that six years of study have provided the data needed to make some decisions about restoration and retrofit projects in the watershed, and that funds budgeted for the semi-annual biomonitoring and assessment could more usefully be directed to other monitoring efforts. However, two continuous monitoring stations will be established in the stream in 2009 – one upstream of the plaza and one downstream –to monitor turbidity and conductivity during the construction of the new facility.

3. Performance and Maintenance Study of Delaware Sand Filters

In late 2006, we began a study to determine maintenance requirements for the numerous Delaware sand filters that have been installed by DelDOT in roadways, transit facilities, and Park-and-Ride lots. These BMPs currently are inspected on an annual basis. The criteria for determining when and how each sand filter should be maintained, however, has never been clarified or standardized. The sand filters owned and maintained by DelDOT encompass a number of different designs, and the various units receive a wide variety of drainage and pollutant loads. Therefore, each type of sand filter may require a unique maintenance schedule and plan. The goal of this study is to determine a maintenance plan and schedule for each of the sand filter types owned by DelDOT, dependent upon its design, location, land use drainage, and pollutant loads.

2008 was the third year of the study: In this year we focused on continuing the dry and wet weather observations, collecting sand samples for laboratory analysis, and critiquing the current study methodologies

KCI selected four sand filters that were determined to be representative of a variety of typical land use settings (commercial, roadway, and parking lot) and different sand chamber designs:

- Lancaster Pike (DelDOT BMP 72)
- Route 273/Route 7 Park and Ride lot (DelDOT BMP 46)
- Wilmington Delaware Transit Corporation (DTC) Bus Facility DSF
- Chapman Maintenance Yard – a Stormceptor/sand filter treatment train for a truck wash area

All of these selected sand filters are being monitored in order to more fully understand the key parameters that affect long-term performance and to develop a standardized inspection and maintenance protocol for DelDOT that will ensure that all of our sand filters continue to provide the maximum water quality treatment. Quarterly wet- and dry-weather field observations are performed, which include:

- *Dry-weather observations:*
  - General investigation of the drainage area, focusing on understanding flow patterns and pollutant sources
  - Sedimentation chamber: depth of water and sediment; presence of oil or grease
  - Sand chamber: depth of gravel, sand, discoloration and debris; evidence of clogging and/or oil and grease; presence of water
  - Recorded date of previous rainfall
  - Photographs
- *Wet-weather observations:*
  - General investigation of drainage area
  - Sedimentation chamber: depth of water and sediment; presence of oil and/or grease
  - Sand chamber: evidence of water, clogging, and oil/grease; infiltration rate measurement
  - Recorded date of previous rainfall
  - Photographs

KCI's 2008 end-of-year report on this project is included here as Appendix I. It details the results of the quarterly monitoring of each sand filter, as well as results of chemical analyses of core samples taken from the sand filter at the Wilmington DTC site.

Each of the sand filters under study has had very unique issues, due to differences in design and pollutant loading. The unit at the Rtes. 273/7 Park and Ride lot receives only modest input of sediment and organic matter, and it has performed well with little to no maintenance. The filter on Lancaster Pike collects a large amount of leaf litter and organic debris in the fall. Thus far the infiltration rates here have not been severely impacted by this debris, but we suspect that the organic matter will eventually clog the sand chamber. These units may do well with periodic removal of only the top layers of accumulation from the sand bed. The sand filter at the Wilmington DTC site receives larger inputs of hydrocarbons than the others, and our core sample analyses indicate that more regular replacement of the sand bed media may be needed there. The final filter under study at the Chapman Road maintenance yard has experienced persistent problems with clogging and appears not to be an appropriate BMP for truck wash operations (see subsection 4 below).

4. Study of a Treatment Train for Maintenance Vehicle Washwater

DelDOT has been partnering with Rinker Materials and Imbrium Systems to test and evaluate a new stormwater treatment train concept that includes a Stormceptor hydrodynamic separator as pretreatment for a standard Delaware sand filter. The anticipated advantage is that the Stormceptor will essentially replace the function of the sand filter's sedimentation chamber and allow for smaller sizing and less frequent maintenance of the sand filter.

The ability of the Stormceptor to remove large amounts of sediment and floatables such as oils and greases made this treatment train concept attractive to DelDOT for use in treatment of runoff from maintenance yard vehicle washing operations. We decided to install these BMPs in one of the two vehicle wash areas of the Chapman Road maintenance facility in Newark, Delaware. The site design includes a 50- by 50-foot paved, sweepable wash pad with sediment pre-screens. Rinker Materials provided the

Stormceptor unit free of charge, and DelDOT funded all other costs. Installation of the treatment train was completed in 2008.

This particular treatment train is unique, not only in design, but also because it provides treatment for a wastewater stream (truck washwater), as opposed to stormwater runoff. The sand chamber design in this train also is unique. It consists of sand at the top and #57 stone at the bottom, with geotextile separating the sand and stone. In addition, the outflow is through two pipes rather than one single perforated pipe.

Truck wash operations at the Stormceptor/sand filter train were sampled in August and October 2008. Monitoring currently is on hold because the sand filter has repeatedly failed. In fact, it may not be an appropriate BMP design for treating sediment-laden truck wash water. KCI staff observing this site and other sand filters in the state have determined that sand filters receiving large quantities of fine suspended solids have typically failed very quickly, as these fine particles clog the sand by completely coating the DSF surface. DelDOT is currently trying to develop a modification to the current design which hopefully will allow the truck wash to be functional.

5. Study of the Impact of Street Sweeping on Removal of Pollutants from Parking Lots

During calendar year 2008, DelDOT completed collaboration with the Department of Natural Resources and Environmental Control (DNREC) on a study of the effectiveness of parking lot sweeping in removing stormwater runoff pollutants. DNREC's Division of Soil and Water received a Section 319 grant to support this study. As match funding for the grant, DelDOT provided monitoring services through KCI Technologies. The stormwater from many commercial areas along roadways eventually end up in DelDOT's drainage system, so DelDOT has an interest in helping these businesses reduce the contamination in their discharges.

In the study we examined the chemical and physical make-up of street sweeper contents collected by a wet-vacuum regenerative air street sweeper from two shopping center sites in the Inland Bays Watershed, Delaware, from November 2006 through December 2007. Sweeping of the lots was conducted twice a week at each site. KCI Technologies collected samples once a month from the debris collected. The samples were sieved and analyzed for particle size distribution and physical content. A composite

sample from each collection also was sent to Atlantic Coast Laboratories to be analyzed for chemical constituents, including chloride, metals (copper and zinc), nitrogen and phosphorus, and petroleum hydrocarbons.

The study was completed in December 2007, with a total of 14 sample events. A report was written to summarize the results (included here as Appendix J). We also hope to present the results at the 2009 StormCon conference in August, 2009.

Physical characteristics of samples exhibited seasonal variability, which correlated with the tourist season, winter snow management, and natural organic matter accumulation such as grass clippings and leaves in late summer and fall months. Data showed a trend toward decreasing solids accumulation throughout the course of this study for both sites. The median accumulation rate for both sites was 3.3 lbs/ac/d but ranged from 1.7 to 27.4 lbs/ac/d over the study period. Petroleum hydrocarbons tended to be higher at the start of this study and steadily declined over the study period for both sites. This observed trend was most likely due to the gradual removal of residual oil from parking lots through time. The median removal for petroleum hydrocarbons was 0.453 lbs/Ac (0.011 – 4.986 lbs/Ac), total nitrogen 0.277 lbs/Ac (0.277-10.198 lbs/Ac), and total phosphorus 0.123 lbs/Ac (0.016-1.418 lbs/Ac). Such estimates are within the expected range for street sweeping as an implemented BMP.

This study was successful in demonstrating that bi-weekly parking lot sweeping using regenerative air technology results in respectable estimated pollutant removal rates.

6. Study of Alternatives for Managing Vegetation Under Guardrails

In the spring of 2008, we began a study to investigate alternative vegetation management strategies for guardrail and sign posts. Currently growth of vegetation under and around these structures is controlled by annual applications of herbicide. The goal is to find ways to reduce the use of pesticides used to treat guardrail vegetation without compromising safety and aesthetics. The study is being performed by Dr. Susan Barton and Valann Budischak of the University of Delaware Department of Plant and Soil Sciences.

Treatments being evaluated include weed control barriers, chemicals, low-growing vegetation, and hand cutting of existing vegetation. They will be compared

based on effectiveness, ease of implementation, aesthetics, cost and longevity. Test locations were selected to represent typical roadway settings in which guardrails are utilized. Test sites will be monitored and data will be taken monthly for two years.

Twenty-four guardrail plots were established during April and May 2008 on Delaware roadsides. Treatments include three formulations of herbicide, two weed barriers (U-Teck Weedender® and Universal Weed Cover®), hand trimming, pavement, low fescue turf and a control (Figure 13-1). A summary of the plot treatments is provided in Table 13-4. There are three replicates of most treatments. In addition, thirteen signs were selected for test treatments, including U-Teck Weedender® SignMat. Universal Weed Cover is not suitable for use around signs.

The U-Teck Weedender® was installed in June and the Universal Weed Cover® was installed in July. In several places weeds had begun to grow through seams in the U-Teck product by September, and the barrier was recaulked. There were low growing weeds growing over the edge of the U-Teck barrier by the end of July. The Universal Weed Cover® barrier had weeds growing through seams by October. No weeds grew over the edge of the barrier (possibly due to its later installation).

Herbicide treated plots were sprayed once during the season on June 22nd. Herbicide Formulation #1 had the most weed regrowth, but weeds were low and none of the herbicide plots was retreated. Formulation #3, which was the mix designed for sensitive areas, provided the best control of weeds during the first growing season. Control plots had weeds growing taller than the guard rail in some sections. Hand trimmed plots were trimmed twice (May 29th and September 9th) to maintain vegetation below the top of the guard rail. Low fescue plots did not establish successfully after the April seeding, so topsoil was brought in and plots were reseeded in September.

All plots will continue to be monitored throughout the 2009 growing season.

7. Monitoring of BMP Outfalls at DelDOT Maintenance Facilites

DelDOT also performs wet weather monitoring at selected maintenance yard outfalls, incompliance with its industrial permits. See Section 16 of this report ("Pollution Prevention at Maintenance Facilities") for details on this.

Table 13-1. Dry weather flow rating system used by Duffield Associates. An outfall sum of all parameters ≥4 triggers follow-up evaluation.

Parameter	Range	Value
Flow	< 0.022 cfs	0
	≥ 0.022 cfs	4
pH	< 4.5	4
	>8.5	4
	Change ≥ 2.0 units	1
Phenols	< 0.3 ppm	0
	≥ 0.3 ppm	4
Copper	< 0.01 ppm	0
	≥ 0.01 ppm	4
Chlorine	< 0.5 ppm	0
	≥ 0.5 ppm	4
Detergent	< 0.2 ppm	0
	0.2 – 0.4 ppm	1
	≥ 0.5 ppm	4
Odors	Gasoline	4
	Sewage	4
	Oil	2
	Chemical	2
Clarity	Opaque	1
Floatables	Sewage	4
	Oil	4
Stains	Oil	3
	Chemical	3
Ammonia	< 0.05 – 0.1ppm	0
	≥ 0.1 – 1.0 ppm	1
	≥ 1.0 – 2.99 ppm	2

Table 13-2. Summary of total dry weather outfall inventory and follow-up reviews conducted during calendar year 2008 (From KCI Technologies, Inc., Calendar Year 2008 Annual Report to DelDOT). "PID" = potential illicit discharge.

Rescreening of Outfalls with Previous Dry Weather flow						
Month (2008)	**Outfalls Completed**	**Total DelDOT Owned**	**Total DelDOT With Flow**	**Targeted by Rating**	**PID**	**Groundwater**
January	0	0	0	0	0	0
February	4	4	2	2	1	1
March	16	14	14	5	0	14
April	46	35	18	15	0	18
May	36	18	12	0	0	12
June	39	32	24	2	2	24
July	14	7	0	0	0	0
August	0	0	0	0	0	0
September	0	0	0	0	0	0
October	25	14	3	0	0	3
November	10	9	3	0	0	3
December	0	0	0	0	0	0
TOTAL 2008	**190**	**133**	**76**	**22**	**3**	**75**
TOTAL TO DATE	**477**	**369**	**176**	**105**	**5**	**174**

Initial Screening of New Outfalls						
Month (2008)	**Outfalls Completed**	**Total Non-DelDOT**	**Total DelDOT With Flow**	**Targeted by Rating**	**PID**	**Groundwater**
January	19	0	0	0	0	0
February	21	0	0	0	0	0
March	14	0	0	0	0	0
April	25	0	1	1	0	1
May	40	0	1	1	0	1
June	32	0	0	0	0	0
July	18	0	0	0	0	0
August	12	0	0	0	0	0
September	25	0	0	0	0	0
October	51	0	0	0	0	0
November	73	0	0	0	0	0
December	31	0	0	0	0	0
TOTAL	**361**	**0**	**2**	**2**	**0**	**2**

Table 13-3. Summary of wet weather monitoring events for catch basin insert filters and retrofit BMPs at DelDOT's I-95 Service Plaza in Newark, Delaware, during calendar year 2008. The last column also provides the total number of samples collected for each BMP or site as of December 31, 2008.

BMP	Installation Date	Sampling Events 2007	Total Events Sampled to Date
HydroKleen Catch Basin Insert	October 2006	2/13/08 4/28/08	10
UltraDrainguard Inlet Filter	November 2006	2/13/08 5/09/08 5/12/08 11/25/08	9
Abtech Ultra-Urban Filters	November 2006	3/05/08 4/28/08 5/09/08 5/16/08 11/25/08	9
Suntree Technologies Grate Inlet Skimmer	April 2007	2/13/08 3/05/08 4/28/08 5/09/08 5/12/08 11/25/08	9
Bioretention Cell	August 2004	-	10
Sand Filter	September 2004	4/28/08 5/12/08	11
StormFilter	September 2004	-	11
BaySaver	June 2005	5/09/08 11/13/08	10
Upstream Site	N/A	11/13/08	20
Downstream Site	N/A	11/13/08	23
Central Manhole	N/A	-	20
Southbound Swale	N/A	-	20

Table 13-4. Summary of test locations and treatments applied in guardrail vegetation management study conducted by the University of Delaware (continued next page).

Treatments:

Weed Barriers	U-Teck Weedender®	Permeable woven fiber mat, pinned down and sealed at the joints.
	Universal Weed Cover®	Interlockling molded plastic tiles, sized to fit typical; guardrail post spacing
	Pavement	Used existing paved locations
Herbicides	Formulation #1	Karmex, Plateau, Accord, Pendimethlin (New Castle County formulation)
	Formulation #2	Accord, Plateau, Pendimethlin (formulation for sensitive areas)
	Formulation #3	Accord
	(Note: only aquatic approved surfactants applied in all tests)	
Other	Low-growing turf grass	(little or no annual rye)
	Hand-trimming	

Guardrail Plots:

Location	Plot Number	Segment Length (ft)	Treatment
Route 13 South	1	100	U-Teck Weedender®
		100	Universal Weed Cover®
		100	Control
	2	300	Herbicide Formulation #1
	3	300	Low-growing Seed Mix
	4	372	Herbicide Formulation #2
	5	300	Herbicide Formulation #2
	6	322	Herbicide Formulation #2
	7	300	Herbicide Formulation #1
	8	300	Hand Trim
	9	448	Herbicide Formulation #3
	10	100	U-Teck Weedender®
		100	Universal Weed Cover®
		154	Control
	11	283	Hand Trimming
	12	338	Pavement Under Guardrail
Route 13 North	14	651	Herbicide Formulation #3
	15	300	Hand Trim
	16	650	Control
	17	300	Herbicide Formulation #1
	18	100	U-Teck Weedender®
		100	Universal Weed Cover®
	19	300	Low-growing Seed Mix
	20	300	Low-growing Seed Mix

Table 13-4. Continued.

Sign Treatments:
(All signs located on I-95 northbound shoulder, just past the DE/MD state border)

Sign Text	Treatment
Welcome to Delaware	Herbicide Formulation #1
No Pedestrians	Herbicide Formulation #2
Speed Limit 55	Herbicide Formulation #3
Carpool	U-Teck Weedender® SignMat
Report Disabled Vehicles	Herbicide Formulation #1
I-95 Sign	Herbicide Formulation #2
Exit 4B (brown sign)	Herbicide Formulation #3
Reduce Speed	U-Teck Weedender® SignMat
Permit & Wide Load	Herbicide Formulation #2
Car Tolls or EZ Pass/Cash	Herbicide Formulation #1
EZ Pass Accepted	Herbicide Formulation #3
Speed Limit 40	U-Teck Weedender® SignMat
3 delineators between MD line & overhead sign “Reduce Speed, Toll Plaza”	Pavement

Figure 13-1. Photographs of guardrail vegetation control treatments under test by the University of Delaware – (A) control; (B) hand trimmed; (C) pavement; (D) low-growth fescue, seeded fall 2008; (E) U-Teck Weedender; (F) Universal Weed Cover; (G) Herbicide Formula 1; (H) Herbicide Formula 2; (I) Herbicide Formula 3.

14. Supplemental Environmental Project

This section pertains to New Castle County only. See Section 14 of New Castle Counties annual report for details.

15. Additional Injunctive Relief

Requirement: Within one year from the date of entry of the Consent Decree, DelDOT shall complete a stormwater retrofit project for a 5.58 mile long section of I-95 incorporating water quality considerations in design and construction of its stormwater management structures as described in the Consent Decree page 25, Part III 30.

Performance: This project is complete. See Annual Report 2001, Volume 3, Appendix U for a complete report and photographic documentation of the I-95 Additional Injunctive Relief Stormwater Controls.

16. Pollution Prevention at the Maintenance Facilities

A. Pollution Prevention Plans

DelDOT's NPDES Program manages a Stormwater Pollution Prevention Program (SWPPP) at all 16 DelDOT maintenance facilities. Development, implementation, and maintenance of the SWPPP provides the maintenance yards with the tools to reduce pollutants contained in stormwater discharges and comply with the requirements of Delaware's "Regulations Governing Storm Water Discharges Associated with Industrial Activity." The program includes a written plan, timeline for plan implementation, inspection schedules, training and monitoring requirements, and proper storage and housekeeping measures. Each SWPPP has a pollution prevention team with designated responsibilities to carry out the plan.

B. Inspections

Pollution Prevention Plan Team members are required to conduct quarterly inspections during dry and wet weather events to look for evidence of stormwater contamination. These inspections began in October 2003 and continued through the 2008 calendar year.

C. Spill Prevention, Control and Countermeasures (SPCC)

DelDOT hired BrightFields, Inc. to assist the Department in complying with EPA's Oil Pollution Prevention regulations (40 CFR 112) contained within the Clean Water Act. An SPCC Plan discusses how the maintenance facility conforms to oil spill prevention and containment procedures. Each SPCC Plan is unique to the facility. BrightFields, completed a full investigation and developed site-specific plans for maintenance facilities that met the above ground storage minimums requiring a SPCC plan. All plans were completed and distributed in 2007. Because of the addition of new above ground storage tanks at Harrington and Cheswold maintenance facilities, Brightfields recently also prepared SPCC plans for these areas, and they were implemented in 2008.

D. Training

The NPDES Program, with assistance from the Center for Safety & Emergency Response Training (CSERT), developed six training videos for our maintenance staff. The videos provide training on protection of stormwater quality in the following areas:

1. Facility and vehicle maintenance
2. Stormwater contamination and spill prevention
3. Vegetation control and pollution prevention on public roads and highways
4. The regulatory requirements of the Spill Prevention Control and Countermeasures (SPCC) plans developed for each maintenance yard
5. Spill response and emergency procedures
6. The proper procedures for responding to facility and non-facility (roadway) based emergency events.

Each maintenance facility has copies of the videos, and current DelDOT personnel and new hires are required to view them. In addition, the NPDES Program also prepares training posters on elements of the PPP and SPCC Plans and distributes them to the yards several times per year.

E. Monitoring

The Pollution Prevention Plans require wet weather stormwater monitoring is required at five maintenance facilities. These facilities were chosen as representative of the 16 facilities located throughout the state. The five yards are: Kiamensi, Bear, Cheswold, Harrington and Georgetown. In October 2008, DelDOT submitted a request to DNREC that the Georgetown Yard pond be exempted from the monitoring requirement. Reconstruction of the BMP earlier in the year significantly increased its storage capacity. Repeated attempts to sample there were unsuccessful, because the pond did not discharge, even during heavy rainfall events. On November 18, 2008, DNREC approved this exemption. Copies of the request and the approval are provided in Appendix K.

Monitoring was conducted during 2008 at each of the other four pond outfalls. Sampling techniques were performed in accordance with the Environmental Protection Agency (EPA) *Stormwater Sampling Guidance Document*, EPA 833-B-92-001 (July

1992). Semi-annual samples were collected once in each of the following six-month periods: January through June, and July through December.

The wet weather monitoring protocol includes 72 hours of antecedently dry conditions, minimum predicted rainfall depth of 0.10 inches, and two full days of standard maintenance yard operations since the last rainfall event. A first flush sample was collected within 30 minutes from the first noticeable flow, and delivered to the laboratory for analysis of total suspended solids, surfactants, chloride, pH, and total petroleum hydrocarbons: gasoline and diesel range organics. Measurements of flow, air temperature, water temperature, pH and turbidity were recorded on-site at the time of sample collection.

Table 16-1 displays the first flush concentrations measured during 2008 for all parameters at each of the four sites. The total suspended solids (TSS) level of 717 mg/L measured at Cheswold yard in January exceeded the benchmark value of 100 mg/L. This was attributed to construction activities that were occurring at the yard during that time period. This construction included retrofit of the stormwater pond, installation of grassed swales and a vehicle wash pad. TSS levels measured at that site later in the year were well below the benchmark. A relatively high level of diesel-range petroleum hydrocarbons (106 mg/L) also was observed in the January sample taken at Bear yard. This exceeded the benchmark value of 15 mg/L for oils and grease. No explanation could be found for this one-time exceedance of the benchmark. The Area Supervisor reported that no leaks, spills or dumping incidents had occurred at the yard on or before the monitoring date. TPH values were found to be normal at the next sample date in the fall.

When monitoring at the maintenance facilities first began in 2004, suspended solids concentrations routinely were found to be high at certain of the yards, including Harrington and Bear (Table 16-2). These yards handle and store large quantities of dirt, sand and other construction materials, and wash vehicles on site. We have also noted higher chloride concentrations in winter samples at yards that have salt storage and deicing operations.

In response to these findings, DelDOT implemented operational changes (including stricter enforcement of materials storage and housekeeping rules) and retrofitted certain yards with new BMPs (e.g., see “Wash Water Plan” section below).

Subsequent monitoring has demonstrated that the BMPs have largely been effective in reducing TSS discharges from the maintenance facility sites, with the exception of temporary spikes during retrofit construction at Bear and Cheswold yards.

F. Vehicle Wash Water Plan

In July of 2005, DelDOT submitted a report entitled *Statewide Vehicle Wash Water Practices for DelDOT Maintenance Yards* (see Annual Report 2005, Volume 2 of 2, Appendix Z) to DNREC. This report outlined the Department's proposal for treating vehicle wash water on-site at our sixteen (16) maintenance facilities. Our goal was to develop options to treat vehicle wash water and stormwater to acceptable levels before it exits our site and enters receiving waters. To meet this objective we developed a stormwater "treatment train" at each maintenance facility. This method incorporates multiple Best Management Practices (BMPs) to treat wash water to the maximum extent practicable. In several cases, existing practices, together with proposed policy changes and employee training, were sufficient to treat the vehicle wash water. In other cases, there is a need to design and construct retrofits at the facilities.

The first retrofit was located at Bear Maintenance Yard. We constructed an open drainage system in the stockpile area of the yard that includes eight (8) drainage swales, conversion of the current dry stormwater pond to a wet pond for added water quality benefits and designated travel roads were constructed to reduce erosion. The retrofit design was completed in 2006. Construction started in September 2006 and was completed in the spring of 2007.

Although not in the Phase I permit area, Cheswold maintenance facility was retrofitted in 2007. We constructed a vehicle wash pad with a sediment screen that drains to a vegetated swale then to a catch basin fitted a Suntree catch basin insert for capture of sediment and other pollutants. The existing dry pond was upgraded by adding a forebay to capture sediment.

Design has been completed for retrofits at the Middletown maintenance facility. Improvements include adding a forebay to the existing dry pond, creating bioswales, and concrete wash pads. The project is scheduled to be advertised in January 2009.

Table 16-1. 2008 wet weather monitoring results from DelDOT maintenance facility BMP outfalls. The samples were collected once in each of the following six-month periods: January through June, and July through December.

PARAMETER	KIAMENSI		BEAR		CHESWOLD		HARRINGTON	
	01/11/08	09/06/08	01/18/08	09/06/08	01/11/05	09/06/08	02/01/08	09/06/08
Total Suspended Solids	53	26	18	107	717	51	60	48
Surfactants, MBAs	0.17	0.26	0.18	0.27	0.28	1.6	0.16	0.69
Chloride	530	1190	737	39.3	471	107	1870	331
TPH-Gasoline Range Organics	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TPH-Diesel Range Organics	0.45	0.28	106	0.14	0.1	3.62	<0.13	0.24
pH	7.3	7.35	ND[1]	7.31	8.11	7.13	6.97	7.26

[1]No pH measurement due to laboratory error.

Table 16-2. Summary of wet weather first flush data collected from BMP outfalls at representative DelDOT maintenance facilities, 2004 to 2008. .

KIAMENSI YARD	Nov-04	Dec-04	Oct-05	Jan-06	Jul-06	Mar-07	Aug-07	Jan-08	Sep-08
Total Suspended Solids	28	12	13	56	52	82	33	53	26
Surfactants (MBA's)	0.80	0.06	0.21	0.14	0.17	0.53	0.37	0.17	0.26
Chloride	254	230	1144	17911	424	5750	1910	530	1190
TPH-DRO	0.31	0	0.22	0.13	0.12	0.24	0.18	0.45	0.28
pH	7.52	7.37	7.39	6.67	7.06	7.38	8.26	7.3	7.35

BEAR YARD	Nov-04	Oct-05	Jan-06	Jul-06	Mar-07	Jul-07	Jan-08	Sep-08
Total Suspended Solids	65	2530	71	677	318	783	18	107
Surfactants (MBA's)	0.17	0.31	0.16	0.13	0.15	0.18	0.18	0.27
Chloride	693	483	1487	124	806	260	737	39.3
TPH-DRO	<0.11	0.20	0.19	0.21	0.22	0.18	106	0.14
pH	7.86	8.22	7.70	7.40	7.11	7.10	*	7.31

CHESWOLD YARD	Nov-04	Dec-04	Jan-06	Sep-06	Jan-07	Aug-07	Jan-08	Sep-08
Total Suspended Solids	525	39	47	45	6	469	717	51
Surfactants (MBA's)	0.49	0.03	0.09	0.29	0.21	0.43	0.28	1.6
Chloride	346	13.6	1993	242	457	443	471	107
TPH-DRO	0.96	<0.10	0.18	0.14	<0.1	0.22	0.1	3.62
pH	7.62	6.59	7.96	7.22	8.24	7.68	8.11	7.13

HARRINGTON YARD	Nov-04	Dec-04	Jan-06	Sep-06	Jan-07	Sep-07	Feb-08	Sep-08
Total Suspended Solids	320	2130	195	15	106	9	60	48
Surfactants (MBA's)	0	0	0.22	0.27	0.1	0.23	0.16	0.69
Chloride	195	504	1453	186	83.2	96.6	1870	331
TPH-DRO	0.14	0.15	0.00	0.20	0	0	0	0.24
pH	7.67	6.80	6.90	6.84	7.24	7.59	6.97	7.26

KIAMENSI YARD	Nov-04	Dec-04	Jan-06	Sep-06	Jan-07	Aug-07
Total Suspended Solids	17	39	47	36	17	19
Surfactants (MBA's)	<0.02	0.03	0.09	0.13	0.08	0.17
Chloride	12.2	13.6	1993	15.9	8.87	17.3
TPH-DRO	<0.10	<0.10	0.18	<0.10	<0.1	0.14
pH	7.19	6.59	7.96	6.92	7.38	6.9