

**MARYLAND DEPARTMENT OF THE ENVIRONMENT
WATER MANAGEMENT ADMINISTRATION**

**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
MUNICIPAL SEPARATE STORM SEWER SYSTEM DISCHARGE PERMIT
MD0068306**

REVIEW OF ANNE ARUNDEL COUNTY'S 2006 - 2009 ANNUAL REPORTS

Anne Arundel County was reissued a National Pollutant Discharge Elimination System (NPDES) municipal separate storm sewer discharge permit (MD0068306) on November 8, 2004. NPDES regulations require permit conditions that effectively prohibit non-stormwater discharges and reduce the discharge of pollutants to the "maximum extent practicable." For each year of the County's permit, an annual report is required to help assess NPDES stormwater related programs. The following is a review of the annual reports submitted to the Maryland Department of the Environment, Water Management Administration (MDE/WMA) by Anne Arundel County.

Permit Administration

Anne Arundel County is required to identify key administrative and technical personnel responsible for NPDES permit compliance. The required information, including primary NPDES contacts and an organizational chart, was submitted to MDE in each annual report. This information is considered complete.

Legal Authority

Anne Arundel County is required to maintain adequate legal authority throughout the permit term according to 40 Code of Federal Regulations (CFR) 122.26(d)(2)(i). Prior to 2005, the County demonstrated that adequate NPDES legal authority was maintained. In 2005, the County Code was reorganized and NPDES-related legal authority was moved to Article 13 Public Works, Title 5 Water and Wastewater, Subtitle 5 Wastewater Discharge Requirements.

During an evaluation of the County's stormwater management program conducted in the Summer of 2005, MDE found the County's ordinance as contained in Article 21, Title 3 of the County Code, to be acceptable. Shortly after that evaluation, the County Code was reorganized and the legal authority for the County's stormwater management and erosion and sediment control programs was moved to Article 16. These changes were made without prior review or approval by MDE. Also in late 2005, the County initiated a review with the intent to revise Article 16 by the end of 2006. However this initiative was postponed because of changes in the County's administration in the Fall of 2006 and passage of the Stormwater Management Act of 2007.

In November 2009, the County's Office of Planning and Zoning (OPZ) and Department of Inspections and Permits (DIP) submitted revisions to sections of County Code (Articles 16, 17, and 18) that reflected changes to the State's program mandated by the Stormwater Management

Act of 2007. Since then, the County has submitted and MDE has reviewed several drafts of Article 16 of the County Code. To date, many of the shortcomings identified during these reviews have not been addressed, and accordingly, MDE has not approved the County's updated stormwater management ordinance.

In the review of the 2005 Annual Report (MDE, 2006), MDE commented that proposed changes to the County's Code should be submitted to MDE for approval. While proposed revisions to Article 16 have been submitted, it is unlikely that the County will adopt an MDE-approved stormwater management ordinance by the end of 2010. Currently, the ability to maintain adequate legal authority is uncertain as the County does not have an MDE-approved stormwater management ordinance. Equally troublesome, however, is that many of the changes made to the County's Code for other NPDES-related activities (e.g., erosion and sediment control, illicit discharge) have not been submitted to MDE. MDE considers this a permit noncompliance issue. Anne Arundel County needs to take immediate steps to address these ordinance shortcomings and eliminate any questions regarding legal authority.

Source Identification

In its NPDES permit, Anne Arundel County is required to identify sources of pollutants in stormwater runoff and link them to specific water quality impacts on a watershed basis. There are three main components to this work: researching office documents, collecting and verifying data in the field, and developing a geographic information system (GIS). To demonstrate this capability, the County is required to submit information regarding its storm drain system, urban best management practices (BMPs), impervious surfaces, monitoring locations, and watershed restoration locations in GIS format. Efforts to accomplish these tasks have been significant and the County's progress is described below.

The County-wide inventory of storm drains, manholes, outfalls, culverts, and pipes for all watersheds was completed in 2008. GIS data were included in the 2008 report and contained information for 6,097 outfalls, 32,545 inlets, 15,597 manholes, and 51,674 pipe sections. The outfall database was prepared in the required format. GIS information for this database was derived from field surveys, digitized as-built plans, and Digital Elevation Models (DEM) derived from Light Detection and Ranging (LIDAR) imagery. Based on this system, outfall drainage areas and hydrologic conditions may be determined at any storm drain outfall within the County or for any specific project. This process is fully automated for the Severn, South, Upper Patuxent, Magothy, Patapsco Nontidal, Patapsco Tidal Rivers, and Bodkin Creek watersheds.

Using data culled from both County and State Highway Administration (SHA) GIS sources, storm drainage infrastructure layers were completed for the Severn, South, Magothy, and Upper Patuxent River watersheds. Maps of all drainage areas to outfalls within the Upper Patuxent and Magothy River watersheds, and major outfalls within the Severn and South River watershed were provided in the 2007 and 2008 reports. Maps of drainage areas to outfalls within the Patapsco Nontidal, Patapsco Tidal, and Bodkin Creek watersheds were provided in 2009. The County expects to complete delineation of the remaining outfalls in the Severn and South River watersheds by 2010. The County also expects to review and update the drainage area boundary GIS layer on an annual basis to reflect future development and retrofits.

In its 2006 annual report, Anne Arundel County provided a copy of its Urban BMP database that contained 8,860 records. In the 2009 annual report, records in the County's Urban BMP database increased to 10,677 records. By 2009, the County completed BMP inventories for the Severn, South, Upper Patuxent, and Magothy River watersheds, and the Patapsco Nontidal watershed. In 2007, the County also updated records for the Patapsco Tidal and Nontidal watersheds on a limited scale to support Total Maximum Daily Load (TMDL) development for the Baltimore Harbor watershed.

Anne Arundel County continues to make significant progress delineating controlled and uncontrolled impervious surfaces. The County maintains an inventory of five GIS elements with information on County-wide impervious cover, urban stormwater BMPs, non-County controlled lands, environmental retrofits and restoration projects, and a raster analysis of connected and disconnected impervious surfaces. These layers are used to determine the amount of controlled and uncontrolled imperviousness at the watershed scale. In the 2007 and 2008 annual reports, the County provided information on and maps of both the total amount of impervious area and the area controlled by BMPs for the Severn, South, Magothy, and Upper Patuxent River watersheds. Of the 125,731 acres within these watersheds, 16.4% or 20,622 acres are impervious, and 53% of the total impervious acres within these watersheds are controlled by BMPs. The amount of treated impervious area increases to 56% when retrofits and restoration projects constructed within these watersheds during the current permit term are included.

From 2006 to 2008, the County based the delineation of impervious cover on development conditions as captured on one-meter resolution satellite imagery from May 2004. Recently, the County has been updating impervious cover information using 2007 imagery. This newer imagery is captured at a higher resolution with more detail and impervious features may be delineated more accurately. This information was used to update impervious area accounting for the County's twelve watersheds in the 2009 report. Of the 265,236 acres within the County, 16%, or 42,800 acres, are impervious. Of this total, 6,853 acres of imperviousness are located outside the County's jurisdiction on State and federal property or within the City of Annapolis.

The County is required to provide chemical, biological, and physical monitoring locations and watershed restoration areas. Parole Plaza, Church Creek, and Picture Spring Branch were identified in the 2008 and 2009 reports as the three sites where the County conducts this monitoring. A summary of monitoring activities at these sites, and complete monitoring reports were included with the annual reports.

In addition to the ongoing monitoring activities, the County has designed a biological monitoring program based on the Maryland Biological Stream Survey (MBSS). This program uses probability-based random sampling of benthic macroinvertebrates to evaluate watershed conditions County-wide. Since the program's 2004 inception, 20 quality control and 287 assessment site samples have been collected representing all of the County's major watersheds. Locations of the sampling sites and a summary of the results are included in the 2009 report.

Finally, for watershed restoration locations, the County has provided information in the 2009 report listing all of the restoration projects implemented between 2004 and 2009. Further, the

County has identified 167 projects with positive water quality benefits where construction is complete. Of these projects, the County has constructed 33 bioretention practices, and stabilized or restored 16 different storm drain outfalls using coastal plain outfall and step pool conveyance system designs. The County's progressive strategy of using innovative, natural designs to provide upland stormwater management and rehabilitate storm drain outfalls should help improve water quality in receiving waters.

The County also lists 83 projects consisting of installing a total of 141 individual rain barrels at various private residences. Many of these installations were funded and/or undertaken by private nonprofit groups. The County's efforts in fostering watershed stewardship are commendable. However, given the limited ability of one or two rain barrels to reduce runoff, it would be more appropriate to report these projects based on the cumulative impact of the total number of rain barrels installed within each community.

Anne Arundel County continues to make progress toward meeting its watershed restoration goals. It should be noted that future permit requirements will be more stringent. Anne Arundel County should be prepared to expand these efforts to meet future permit requirements.

Management Programs

Anne Arundel County is required to conduct preventative maintenance inspections of all stormwater management facilities at least on a triennial basis. Additionally, documentation identifying the facilities inspected, the number of inspections, follow-up inspections, and the enforcement action(s) used to ensure compliance are to be submitted in the County's annual report. The County reported that a total of 2,561 maintenance inspections were performed during the four reporting terms. Although not identified in the 2007 report, inspections resulted in 33, 47, and 120 maintenance correction notices in 2006, 2008 and 2009, respectively. The County also reported that for these years, compliance was obtained for all but 6 of these notices.

In 2007, Anne Arundel County developed a field manual to standardize the inspection of stormwater management ponds and infiltration trenches. This manual uses elements from both MDE's Draft "Construction and Maintenance Inspection Manual" (MDE, 2006) and the SHA's maintenance program to promote reproducible and reliable inspections. Coupled with a comprehensive database that includes spatial inventory data, BMP type and location, photographs and drainage information, this program will help greatly enhance the County's ability to track and enforce BMP maintenance.

The County is also required to implement the stormwater management design policies, principles, methods, and practices found in the 2000 Maryland Stormwater Design Manual (Design Manual). Currently, two agencies, DIP and the OPZ share responsibility for implementing the County's stormwater management program. In its 2005 evaluation of the County's stormwater management program, MDE found that although the program was considered acceptable, there were several weaknesses relative to plan review consistency, waivers, and communication between plan review (OPZ) and field inspection (DIP) staff. These findings were similar to those discovered in the past, especially with respect to the inconsistent

quality of approved plans and problems related to fragmentation of the County's program among different agencies.

In addition to Article 16 of the County Code (see discussion above), Anne Arundel County uses its "Stormwater Management Practices and Procedures Manual" (Procedures Manual) to provide guidance about stormwater management design and implementation. This document provides detailed information on the County's policies and technical requirements for County-specific design criteria, plan approval processes, construction inspection procedures, and maintenance responsibilities. MDE reviewed a draft of the Procedures Manual in December 2003 and found several items that needed to be addressed prior to final approval. To date, MDE has neither reviewed nor approved the final version of the Procedures Manual.

In 2010, the County submitted proposed changes to the Procedures Manual to reflect recent changes to the State's stormwater management regulations and the requirements of the Stormwater Management Act of 2007. During its subsequent review, MDE found several program elements that were either missing or addressed only as references to other documents, most notably the Code of Maryland Regulations (COMAR). More alarming however, is that the authority for the County's stormwater management program is still distributed across multiple documents, including COMAR. This structure increases the difficulty for the regulated community to fully comprehend local stormwater management requirements and does not comply with State law.

Historically, Anne Arundel County's ability to maintain an acceptable stormwater management program has been diminished by the fragmentation of the program across multiple agencies and/or documents. In January 2010, the County asserted that its stormwater management program could not be presented in a single document as recommended by MDE. However, the County also assured MDE that all required elements would be referenced in Articles 16 and 17 of the County Code and that the Procedures Manual would provide the necessary guidance to unify the program. To date, MDE has not approved nor has the County adopted the changes needed to accomplish this unification, and the County's ability to maintain an acceptable stormwater management program is uncertain.

The County is required to maintain an acceptable erosion and sediment control program. Additionally, any needed program improvements identified during MDE's evaluation of the County's application for the delegation of erosion and sediment control enforcement authority are to be addressed. MDE conducted its biennial review of the County's erosion and sediment control program at the end of the 2008 reporting cycle. As a result of this review, the County's delegation of authority was extended to June 30, 2011. The County continues to maintain an acceptable erosion and sediment control program and has adopted many of MDE's previous recommendations for improvements.

The County is also required to conduct responsible personnel certification classes to educate construction site operators regarding erosion and sediment control compliance. Program activity is to be recorded on MDE's "green card" database and submitted with annual reports. The County conducted three classes in 2006 and 2007. More recently, the Anne Arundel Soil Conservation District has accepted the responsibility for this task and conducted one class in

2007, and three classes in 2008 and in 2009. The required databases for identifying responsible personnel were submitted for each reporting cycle.

The County also must report information regarding earth disturbances exceeding one acre or more. This information should be submitted quarterly and be specific to the permitting activity for the three months preceding submittal. While not in quarterly reports as indicated in the permit, the County has consistently provided the required information in database form with each annual report.

The County is required to implement an inspection and enforcement program to ensure that all discharges to and from the municipal separate storm sewer system that are not composed entirely of stormwater are either permitted by MDE or eliminated. At a minimum, the County is to field screen 150 outfalls annually, conduct routine surveys of commercial and industrial watersheds for discovering and eliminating pollutant sources, and maintain a program to address illegal dumping and spills. The County must also use appropriate enforcement procedures for investigating and eliminating illicit discharges, and report significant discharges to MDE for enforcement and/or permitting.

As a result of its field screening efforts, the County reported no illicit connections in 2006. In 2007, the County focused its screening efforts to four major areas, Crofton, Odenton, Maryland City, and Severn, and found two illegal discharges and six structural problems. Each case was referred to the appropriate County agency (e.g., Inspection and Permits) for correction. However, there was no indication in the annual report of the results of these actions.

In 2008, the County inspected 154 commercial and industrial storm drain outfalls in the Stony Creek and Rock Creek watersheds, the MD Route 100 corridor from MD Route 2 to Gibson Island, and The MD Route 2 corridor from MD Route 648 to Mountain Road. During these inspections, the County found two potential illicit connections and two maintenance problems. The discharge from one of the illicit connections contained elevated levels of ammonia and the case was referred to MDE for further action. The other illicit discharge was identified as sewage and/or food waste and the case was referred to the County's Health Department for further action. One of the maintenance problems was a clogged riser in a privately-owned stormwater management pond. In this case, a corrective notice was issued and the riser was repaired. The second maintenance case was a County-owned outfall with structural problems; funding has been requested for the needed repairs.

In 2009, the County revisited all of the sites where problems were reported during the current permit term and within the southern portion of the County and the Patapsco Nontidal watershed. In these areas, the County inspected 150 commercial and industrial storm drain outfalls. The County found dry weather flow at 20. After further investigation and sampling, the County identified six outfalls with illicit conditions and eleven with significant structural and/or erosion problems.

In addition to investigating outfalls, County personnel visually inspected all accessible commercial and industrial sites within the targeted areas to identify poor housekeeping, dumping, or other non-permitted discharges. Of the 19 identified in the 2005 – 2008 surveys, 10

sites exhibited similar conditions during the re-inspection. County staff also identified six new pollution sources.

The results of these illicit discharge and outfall investigations were forwarded to the County's DIP and/or the Department of Health for further action. In each case, the County issued enforcement actions, including cease and desist orders, violation or correction notices, and stop work orders to the tenants or property owners. Also, six of these violations were referred to MDE's Compliance Program for possible State enforcement action. MDE issued two cease and desist orders and a violation notice for non-compliance with an NPDES permit.

In Anne Arundel County, DIP maintains the program for inspection and enforcement for illicit dumping and spills. In 2009 alone, the County received 880 complaints through its environmental hotline. However, none of these complaints were related to illegal dumping or spills. During the reporting periods, Anne Arundel County responded to an average of four complaints per year regarding dumping and spills. For each illegal dumping or spill case reported, DIP responded to correct the problem, and where appropriate, referred violations to MDE for enforcement.

The County is required to identify all County-owned and municipal facilities requiring NPDES stormwater general permit coverage and submit Notices of Intent (NOI) to MDE for each. Additionally, the status of pollution prevention plan development and implementation is to be reported annually. Seventeen facilities were identified as being required to have a discharge permit. These included seven water reclamation facilities (WRF), three landfill and resource recovery facilities (LRRF), and seven road operations facilities.

In December 2008, the U.S. Environmental Protection Agency (EPA), Region III conducted a compliance inspection of the County's NPDES permit and noted several violations at County-owned facilities including deficiencies with stormwater pollution prevention plans (SWPPP) at several facilities and stormwater management problems at two of the road operations facilities. As a result of that inspection, EPA issued an administrative order (CWA-03-2009-0165DN) in July 2009 requiring that the discovered violations be addressed. By December 2009, the County had addressed the deficiencies noted in EPA's order. However, the County needs to be more proactive with implementing SWPPPs and maintaining stormwater management practices at its facilities.

The County is required to develop and implement a plan to reduce pollutants associated with its road maintenance activities. At a minimum, annual progress reports are to be submitted that document street sweeping, inlet cleaning, roadside vegetation management, and winter weather deicing activities. During the reporting period, an average of 1,070 miles of road was swept annually. Additionally, the County cleaned an average of 6,772 structures (e.g., inlets, catch basins) and 197,500 linear feet of open ditches and curbs and vacuumed 3,900 inlets each year.

In 2006 and 2008, the County applied an average of 7,385 tons of salt for road deicing. In 2007 and 2009, approximately 12,800 tons and 12,405 tons of salt were applied. There is a marked increase in the amount of salt used in 2007 and 2009 versus 2006 and 2008. However, the application of road salt varies from year to year depending on winter weather conditions. For

example, 82% (approx. 10,500 tons) of 2007 total was applied during one event, a snow and ice storm in February 2007.

While glyphosate (i.e., Roundup™) is used to control vegetation growth on County roads and rights-of-way, the amount used has decreased dramatically during the reporting period. In 2006 and 2007, 4,581 gallons and in 2007, only 3,445 gallons were used, respectively. Likewise, only 60 gallons of the herbicide were used in 2008. In 2009, the application of glyphosate increased to 80 gallons as a result of crack-sealing work on roadways. Anne Arundel County is commended for the efforts to reduce pesticide and fertilizer use in its road maintenance program.

The County is required to implement a public education and outreach program to reduce stormwater pollutants. Outreach efforts are to be integrated with all aspects of the County's NPDES activities, documented, and summarized in each annual report. At a minimum, the County is to establish and publicize a compliance hotline for the public reporting of suspected illicit discharges, illegal dumping, and spills. The County operates its "Environmental Hotline" 24 hours a day, 365 days per year. During the reporting period, the County reported receiving an average of 1,000 complaints each year. The majority of these were related to erosion and sediment control or Critical Areas violations as no spill or illicit storm drain connection complaints were reported in 2007, 2008, or 2009. No reasons were offered in the annual report for the lack of spill and illicit discharge complaints. However, the County should consider strengthening outreach efforts in this area. At a minimum, the County needs to better publicize the availability of the hotline for these purposes.

The County must provide information regarding various water quality issues to the general public. The County continues to implement a diverse public outreach program that informs residents on water quality issues and environmental stewardship. Recent activities include participating in numerous public, community, and school events. This includes disseminating information regarding pollution prevention, recycling, lawn care, and household hazardous waste.

One specific public outreach program is the Watershed Stewards Academy. This program trains community leaders to promote watershed restoration and preservation. This is accomplished by training the "Master Watershed Stewards" to develop partnerships between government agencies, citizens, businesses, and organizations and address stormwater problems on a subwatershed level. The Stewards are expected to lead local efforts to implement preservation and restoration projects. During 2006 and 2007, the County worked to secure funding for this progressive program. In 2008, and with funding in place, the Academy was established and the first class of Master Watershed Stewards was trained in 2009. Also in 2009, the County recruited and started training a second class of 23 Stewards.

Anne Arundel County actively participated in the Patapsco/Back River and Lower Western Shore Tributary Teams throughout 2006 to 2009. During this period, County staff served as the Chair of the Lower Western Shore Team and as the County's designated Commissioner and alternate for the Patuxent River Commission. As part of these efforts, the County helped conduct forums to promote environmentally sensitive design within its jurisdiction.

The County also met with the Severn, South, Rhode/West, and Patuxent Riverkeepers throughout the reporting period. Meetings were conducted quarterly to enhance communication and foster cooperation between the County and these organizations. These efforts have resulted in several successful projects including the development of road signs for various watersheds, stormwater management retrofits, and purchasing of undeveloped lands.

Anne Arundel County has successfully implemented many of the stormwater management program elements required by its NPDES permit. A noteworthy effort has been put forth to implement erosion and sediment control and public outreach requirements. Significant improvement has been made to address illicit discharge detection and elimination requirements. However, there have been problems with SWPPPs and maintenance concerns at facilities with NPDES stormwater general permit coverage. Likewise, the status of the County's stormwater management program is uncertain as MDE has yet to approve either the legal foundation or guidance documents.

Watershed Assessment and Planning

Anne Arundel County must conduct a systematic assessment of water quality within its 12 identified watersheds. The goal is to have all land area in the County covered by a specific watershed management plan to address any problems identified. The County completed the Severn River Watershed Management Plan in 2006 and the South River and Upper Patuxent River Watershed Management Plans in 2008. The Magothy River Watershed Management study was completed in 2009. Also in 2009, the County completed field assessment work for the Patapsco Nontidal watershed and benthic bioassessment studies for the Patapsco Tidal and Bodkin Creek watersheds.

Anne Arundel County submitted the Final Report for Severn River Watershed Management Master Plan with the 2006 Annual Report. Developed over several years, the report characterizes baseline conditions and resources, assesses concerns, and identifies opportunities for restoration and preservation within the watershed. Land use within the Severn River watershed varies ranging from highly-developed areas (e.g., the City of Annapolis) to protected natural areas (e.g., Severn Run). However, single family residential development is the most common land use accounting for 38% of the watershed. The County conducted habitat assessments on 89 of the 152 miles of streams within the watershed and found that, although the Maryland Physical Habitat Indices (MPHI) were "good" for 40% of the stream miles, the mean and median scores for the entire watershed were "fair" and "poor", respectively. The results of a comprehensive bioassessment of 63 sites mirrored the MPHI scores as the mean score, 2.6, indicated "poor" conditions. Water quality samples collected at all of the monitoring stations were generally within the regulatory limits and typical of coastal plain streams.

The County combined these results and computer modeling to establish priorities for restoring impaired subwatersheds and preserving healthy ones. Lists of possible restoration techniques (e.g., stormwater retrofits, septic system upgrades) and preservation options (e.g., land conservation, cluster developments) were prepared for each category. Additionally, an implementation plan was presented that prioritized specific options based on cost effectiveness,

ease of implementation, and operation and maintenance needs. Using these tools, the County prioritized the list of alternatives to guide future decisions within the watershed.

The South River Watershed Study was submitted with the 2008 Annual Report. During the course of this study, the physical, chemical, and biological conditions were assessed for approximately 246 miles of streams within the watershed. The median MPHI score of the 696 stream reaches assessed was 77.84 or “partially degraded.” However, only 11% of these reaches were either “degraded” or “severely degraded.” In addition to this assessment, instream and riparian features were inventoried for all perennial, intermittent, and ephemeral channels. Each feature was assessed for impact on the stream channel and given an impact score. The features assessed included buffers, erosion, obstructions, crossings, utilities, dump sites, head cuts, pipes, and ditches. The results of this inventory were combined with the MPHI scores to generate a final habitat score (FHS) for each reach. The mean and median FHS scores were 71.77 and 74.29, both indicating “partially degraded” conditions for the entire watershed.

Between August 16 and October 16, 2006, Anne Arundel County collected dry weather grab samples and discharge estimates at 54 sampling sites distributed throughout the South River watershed. Grab samples were then analyzed for total nitrogen (TN), total Kjeldahl nitrogen (TKN), nitrate (NO₃), nitrite (NO₂), total phosphorus (TP), total suspended solids (TSS), copper (Cu), lead (Pb), zinc (Zn), and fecal coliform. This information was used to identify unusual pollutant loads and characterize base flow pollutant loadings for water quality modeling.

Nitrogen (NO₃, NO₂, TKN & TN) levels in the base flow samples were within the low to acceptable range when compared to water quality thresholds set by the MBSS. TP levels were in the moderate to high range when compared to the MBSS thresholds. TSS levels were within the moderate range as well. Measured levels of lead, copper, and zinc fell well below both the chronic and acute levels listed in the Numerical Criteria for Toxic Substances in Surface Waters (COMAR 26.08.02.03-2). Finally, fecal coliform bacteria levels were variable across the watershed with a mean value close to 620 MPN/100 mL. However, there were some bacteriological concerns at 8 sites where values were above 1,000 MPN/100 mL.

Anne Arundel County conducted bioassessments at 30 sites within the South River watershed using both EPA’s Rapid Bioassessment Protocol (RBP) and the MPHI. The results indicated that the physical habitat in the watershed was rated by RBP as “supporting” or higher and by the MPHI as “partially degraded” or higher. Of the 30 sites sampled, only one site received a benthic index of biotic integrity (BIBI) macroinvertebrate study rating of “good,” while 11 sites received the next highest rating of “fair.” Most sites were either “poor” or “very poor.”

As in the Severn River Watershed Management plan, the County combined these results and computer modeling to establish priorities for restoring impaired subwatersheds and preserving healthy ones. Again, lists of possible restoration techniques and preservation options were prepared for each category, and an implementation plan was presented. The County prioritized alternatives to guide future decisions within the watershed using these tools.

The Magothy River Watershed Study was submitted with the 2009 Annual Report. During the course of this study, the physical, chemical, and biological conditions were assessed for

approximately 74 miles of streams. Physical conditions were assessed for the 28 miles of perennial reaches and the median MPHI score was 76.5 or “partially degraded.” Instream and riparian features were inventoried for all perennial, intermittent, and ephemeral channels. The results of this inventory were combined with the MPHI scores to generate a FHS for each reach. Greater than 75% of the stream reaches assessed within the watershed were “partially degraded.”

Bioassessments conducted at 27 sites within the watershed using both RPB and the MPHI protocols indicated that the physical habitat in 58% of the sampling sites was “poor” or “very poor.” The remaining sites were rated as “fair.” These results were mirrored by the ratings for aquatic resource indicators as 85% of the subwatersheds measured rated as “medium” or “low.”

The County also compiled data on impervious cover, urban stormwater BMPs, septic systems, and landscape conditions in the upland areas within the Magothy River watershed. Of the 168 stream reaches investigated, 100 were 10% to 25% impervious while another 60 were more than 25% impervious. There are 1,764 urban BMPs within the watershed providing water quality and quantity treatment for approximately 13% of the total area. Over 81% of these practices treat less than one acre. Additionally, there are approximately 9,626 septic systems in the watershed that contribute approximately 178,500 lbs of total nitrogen annually to receiving streams. Finally, the County employed a number of landscape-based indicators (e.g., percent imperviousness, percent forest cover, percent wetland cover) to assess the need for restoration and/or preservation of individual subwatersheds. Most of the subwatersheds rated “medium” to “high” on the need for restoration and “low” on the need for preservation.

The County combined the results of the physical, chemical, and biological assessments and computer modeling to establish priorities for restoring impaired subwatersheds and preserving healthy ones. Lists of possible restoration techniques and preservation options were prepared for each category, and an implementation plan was presented. This plan will be used to guide future decisions within the watershed.

The County continues to do very well with its watershed assessment efforts. Quite a few of the planned restoration and retrofit opportunities are nearing the design and/or construction phase. Ultimately, the success of the County’s assessment and planning efforts will be gauged by implementation of restoration projects and improved water quality.

Watershed Restoration

Anne Arundel County is required to implement the practices identified in its watershed plans. The goal is to maximize the water quality in a single watershed, or combination of watersheds, using efforts that are definable and the effects of which are measurable. At a minimum, the County is to complete the implementation of those restoration efforts that were identified and initiated during the previous permit term to restore ten percent of the County’s impervious surface area. The watershed or combinations of watersheds, where restoration efforts are implemented are to be monitored to determine effectiveness toward improving water quality. The County also is required to implement restoration efforts to restore an additional ten percent of the County’s impervious surface area during this permit term. The progress toward meeting the goal is to be reported annually. Annual reports are to include the estimated cost and the

actual expenditures for program implementation and the monitoring data and surrogate parameter analyses used to determine water quality improvements.

In Anne Arundel County, there are approximately 18,502 acres of impervious surfaces that require treatment. Therefore, the County must restore approximately 1,800 acres of impervious surfaces during each permit cycle for a total of 3,600 acres. The County implemented 164 projects between 2004 and 2009, treating approximately 1,340 acres of imperviousness. Of these, 43 projects were funded by the County. Another 82 were conducted privately in collaboration with the County, and the remaining 39 were constructed through a combination of grants and private funds by stakeholders like the South River Federation and the Severn River Association.

During the current permit term, Anne Arundel County focused efforts on implementing projects in areas where comprehensive watershed studies have been completed. As a result, the County has restored more than ten percent of the impervious surfaces within these watersheds. In the Patapsco Tidal watershed, approximately 11.6% of the uncontrolled impervious surfaces have been restored. Similarly, in the Severn River and South River watersheds, 19.7% and 56.5% of the uncontrolled impervious surfaces have been restored.

On a County-wide basis, only about 7.7% (approx. 1,340 acres) of the uncontrolled impervious surfaces have been restored. While not meeting the initial 10% goal, Anne Arundel County is making considerable progress toward meeting its watershed restoration goals. Currently, the County has at least 30 more projects in various stages of design that will help attain these goals. However, future permit requirements will be more stringent. While continuing the efforts outlined in the watershed management plans, the County should also recognize that the restoration requirements in the future will be even greater.

Assessment of Controls

Anne Arundel County is required to use chemical, biological, and physical monitoring to document work toward meeting the watershed restoration goal. The County has implemented several different types of stream restoration projects to meet this goal. However, the amount of long-term data needed to assess the effectiveness of these projects to reduce nonpoint source pollution is limited. Anne Arundel County and the University of Maryland Center for Environmental Science (UMCES) have been conducting research on nitrogen loads in degraded and restored streams to gain a better understanding of the benefits of stream restoration. Initial findings of this research indicate that nitrogen concentrations usually decreased downstream in restored lowland streams but remained constant or increased in restored headwater streams. However, a consistent pattern could not be discerned for concentrations of TSS in either restored or degraded channels. Likewise, there was little difference in basic channel geometry (e.g., width, depth) between restored and degraded channels. This research is ongoing and the County anticipates publishing initial findings in the 2010 Annual Report.

In addition to the research with UMCES, the County has established a long-term monitoring program in the Church Creek subwatershed of the South River. Chemical monitoring occurs at two stations. The first is at the outfall to Parole Plaza; a recently redeveloped commercial area

that is 87% impervious, while the second is an instream station approximately 2,000 feet downstream of the outfall. From 2006 to 2009, 36 storm events and 11 baseflow samples were collected and analyzed for all of the required parameters except for oil and grease. The results of these analyses and flow measurements were used to develop event mean concentrations (EMCs) that were reported on MDE's Chemical Monitoring Storm Event Database as required. Annual and seasonal pollutant loads were calculated as well.

From 2006 to 2009, the EMCs for the Parole Plaza station were higher than those for the Church Creek station with some exceptions. These exceptions varied on a yearly basis. For example, in 2006, the EMCs for TN, TP, Pb, and Zn were lower at Parole Plaza while in 2007, only the EMC for TPH was lower. Likewise, in 2008 and 2009, the EMCs for TN and E. Coli were lower at Parole Plaza than Church Creek. One possible reason for the variability in results is the influence of construction at Parole Plaza, which was completed at the end of 2008.

The County is also required to conduct biological and physical assessments between the outfall and instream stations. During the reporting period, benthic macroinvertebrate samples were collected from four monitoring stations. The biological conditions at each station were evaluated using the BIBI developed for Maryland's coastal plain streams. Since 2006, all stations have been rated consistently as either "poor" or "very poor." The primary factors contributing to these conditions are degraded physical habitat, altered hydrology, and poor water quality attributed to the high levels of imperviousness and urban nature of the watershed.

The County's physical assessment found that despite the high percentage of imperviousness, the majority of stream reaches within the Church Creek watershed were stable. Some of the County's possible explanations for this are that the storage in stormwater management facilities and wetlands and several grade control structures (e.g., culverts) are buffering the impacts of imperviousness on channel stability. Over the course of the current permit, the stream's physical habitat conditions were considered "degraded" or "partially degraded." These results reflect the increases in runoff, decreases in recharge, and hydrologic alteration associated with increased imperviousness.

The County also must conduct physical monitoring in Picture Spring Branch to assess implementation of the 2000 Maryland Stormwater Design Manual. Monitoring of the physical and habitat conditions within the North and South tributaries began in 2003 and is conducted annually. While there was some enlargement of the South tributary, channel dimensions have changed minimally from 2006 to 2009. Based on these results, the County reports that the BMPs implemented as part of the development of the West County Library have been effective in reducing runoff impacts. Biological assessments were conducted at three stations throughout the watershed. From 2006 to 2008, biological conditions were consistently rated as "fair" to "poor." However, in 2009, the conditions declined as all three sites were rated "poor" to "very poor." While reasons for this are unknown, a decline in water quality may be partly the cause.

The County's monitoring efforts in both the Church Creek and Picture Spring Branch watersheds have improved significantly during the current permit term. The chemical, biological, and physical monitoring in both watersheds has characterized the background conditions in both watersheds. Monitoring within the Church Creek watershed has tracked changes due to ongoing

construction of the Parole Plaza and the effects of urbanization. Likewise, results from the Picture Spring Branch study have shown that the BMPs constructed as part of the West County Library have been effective at reducing channel degradation. Ultimately, these efforts will improve the understanding of pollutant removal efficiencies associated with the County's watershed restoration activities and the effectiveness of Maryland's 2000 Design Manual.

Program Funding

Anne Arundel County is required to maintain adequate funding to comply with all conditions of its NPDES stormwater permit. Funding for the NPDES program is addressed through the County's Capital Improvement Program (CIP) and general funds distributed to the various agencies performing NPDES-related activities. From 2006 to 2008, the operating budget specific to NPDES implementation was approximately \$1.9 million per year.

Capital budget allocations for stormwater runoff controls for 2006, 2007, and 2008 were \$5.2 million, \$4.9 million, and \$2.7 million, respectively. Likewise, budget allocations for water quality improvements were \$8.0 million in 2006, \$6.6 million in 2007, and 7.2 million in 2008. The increase in 2008 water quality funds reflects a one year grant program to implement the Watershed Stewards Academy. If the grant is subtracted from the 2008 figures, capital expenditures on runoff controls and water quality improvements decreased from 2006 to 2008.

In 2009, the County significantly reduced both operating and capital allocations to its NPDES program in order to balance its budget and address economic concerns. In 2009, the operating budget, including staff, for NPDES implementation was approximately \$13.5 million. Excluding funds for staff, the operating budget for the program in 2009 was \$735 thousand. Similarly, allocations for stormwater runoff controls and water quality improvements decreased to \$1.0 million and \$580 thousand. While future budget reductions are anticipated, the County continues to maintain funding and staffing at a level necessary to address NPDES permit obligations. However, future NPDES permit requirements will be more stringent. Anne Arundel County should consider developing a dedicated funding source for its NPDES stormwater programs to reduce reliance on general funds to meet future permit requirements.

Summary

Anne Arundel County has successfully implemented many of the stormwater management program elements required by its NPDES permit. A noteworthy effort has been put forth to implement erosion and sediment control, illicit discharge detection and elimination, and public outreach. Similarly, watershed assessment, restoration, and control assessment efforts are considered to be strong. Other than problems discussed below, the County's management program implementation efforts are considered to be exemplary.

Problems were noted regarding the County's stormwater management program. Currently, Anne Arundel County does not have an MDE-approved stormwater management ordinance. Recent efforts to rectify this situation and implement the requirements of the Stormwater Management Act of 2007 have stalled as the County has not addressed MDE's comments. It is crucial that the County avoid any further delays in complying with the State's stormwater management laws and regulations. Problems were also noted with the implementation of stormwater pollution

prevention plans at County-owned facilities. Although the deficiencies listed in the EPA administrative order were quickly addressed, the County must lead by example and be more proactive with the implementation and maintenance of stormwater management practices at County-owned facilities.