

# New Castle County Storm Water & Drainage Projects

## Program Update September 2011



Regional Storm Water Management Facility at Emily Bissell Hospital

Red Clay Creek Streambank Stabilization in Penn Drew Manor



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## **I. INTRODUCTION**

Drainage and storm water responsibilities in geographic New Castle County are spread among various entities, including the County government (the “County”), the Delaware Department of Transportation (“DelDOT”), the Department of Natural Resources and Environmental Control (“DNREC”), the New Castle Conservation District (the “District”), the Army Corps of Engineers (the “Corps”) and municipalities. This wide-spread division of responsibility for storm water and drainage issues often makes it difficult to determine who is responsible for issues and also makes it challenging to develop comprehensive solutions. Over the past decade, the County’s financial commitment to storm water and drainage programs has increased, partly due to regulatory mandates and partly due to the County’s desire to address flooding situations such as the aftermath of severe storms in 2004. The purpose of this report is to summarize the County’s storm water and drainage programs and to establish a path forward for future projects and budgeting.

The following sections describe each of the County’s storm water and drainage programs, including legal responsibilities, expenditures and accomplishments. The final section proposes a path forward with respect to County storm water and drainage projects.

## **II. WATERWAY MAINTENANCE**

Article 6, Chapter 12 of the *County Code* makes the County responsible for keeping non-tidal waterways not under the jurisdiction of another entity open and free flowing. Article 6 further provides that the County *may* accept responsibility for maintaining open and free flowing conditions in non-tidal streams, communal watercourses and drainage facilities if the following criteria are met: 1) they are not already maintained by another entity, 2) adequate right of way exists, and 3) it is necessary *in the County’s discretion* for proper drainage. These non-tidal streams, communal watercourses, and drainage systems must meet County design criteria and must be affirmatively accepted by the County.

The Special Services Department’s (“Special Service’s”) Construction Support Section keeps non-tidal waterways open and free-flowing. A Staff Engineer responds to an average of 225 drainage complaints annually. This, along with drainage maintenance check points and maintenance to approximately 71 County facilities, generates an average of 1,542 work orders annually, which comprised almost twenty percent of Construction Support’s fiscal year 2011 operating budget.

## **III. STATE SEDIMENT AND STORM WATER PROGRAM AND THE NPDES MS4 PERMIT**

Title 7, Chapter 40 of the Delaware Code requires DNREC to administer the State Sediment and Storm Water Program. Most of these responsibilities have been delegated to the County and include sediment and storm water management plan approval, inspection during construction, post-construction inspection and education/training. Pre-construction and construction issues are handled by the Land Use Department (“Land Use”). Post-construction, inspection, rehabilitation, public outreach and training is handled by Special Services.

Title 40 of the Code of Federal Regulations, which details the broad Clean Water Act mandates, requires the County to obtain a National Pollutant Discharge Elimination System (NPDES) permit for its municipal separate storm sewer system (MS4). The County obtained its NPDES MS4 permit in 2001 (the “NPDES MS4 Permit”) and also entered into a consent decree with EPA that year, which requires the County’s compliance with the 2001 permit and subsequent permits (the “Consent Decree”). The NPDES MS4 permit is a joint permit and other permittees include DelDOT and twelve municipalities.

The NPDES MS4 Permit incorporates most of the County’s responsibilities under the State Sediment and Storm Water Program. Significant accomplishments since the permit was issued include the following:

- 1) Developed an inventory of all storm water management facilities and Best Management Practices (BMPs) (currently 1,535 facilities),
- 2) Inspected all 1,535 storm water management facilities and BMPs annually,
- 3) Obtained design and as-built plans, when possible, from a variety of sources for each pond and BMP (time-consuming task given the number and age of these structures),
- 4) Developed and implemented a program to notify responsible parties of inspection results, as well as the deficiencies that they must rectify (many never even realized they were responsible),
- 5) Ensured that required maintenance was performed through updated correspondence and development of an enforcement program,
- 6) Improved maintenance of County storm water facilities and BMPs,
- 7) Developed and maintained a hazardous spill prevention and response plan,
- 8) Implemented the Amnesty Program, through which the County has gone beyond its permit and Consent Decree requirements to perform major repairs to failing ponds and BMPs in residential communities in exchange for community commitments to perform routine maintenance on a regular basis; have proceeded with \$9.2M in repairs,
- 9) Educated responsible parties and contractors regarding the proper design and maintenance of storm water ponds and BMPs,
- 10) Developed a very stringent protocol for the acceptance inspection of storm water ponds and BMPs to ensure they are in excellent shape when maintenance responsibility is turned over by the developer,
- 11) Performed dry weather screening at the outfalls from structural controls,
- 12) As a pilot program, hired an environmental management company to provide conservation management for four County-owned storm water ponds. The ponds were planted with native vegetation to improve water quality and enhance wildlife habitat. Buffers were established around the ponds to reduce nutrient loadings, provide goose control, and prevent erosion. One wet pond has solar powered aerators for algae control and mosquito eating fish established. Two of these projects are in highly visible County park locations, thereby promoting the benefits of conservation management,
- 13) Developed a working relationship with the Partnership for the Delaware Estuary to complete a retrofit project at the Hockessin PAL facility. The project consisted of planting native vegetation in the two dry ponds. Native vegetation should filter more pollutants than traditional turf grass and will require less maintenance, thus reducing

- maintenance costs and greenhouse gas emissions from mowing (running a traditional lawn mower for one hour is equivalent to driving a car 340 miles),
- 14) Screened all outfalls in the County for illicit discharges,
  - 15) Made significant improvements to the Fats, Oils, and Grease (FOG) program,
  - 16) Performed wet weather monitoring to estimate pollutant loads from differing land use types,
  - 17) Participated in the advisory committees tasked with making changes to State Sediment and Storm Water regulations, and
  - 18) Established a robust public outreach/education program.

The County expects to obtain its new NPDES MS4 Permit in fiscal year 2012. Based on draft permits to date, the County expects its responsibilities to increase significantly and is estimating that the new permit will require an additional \$2M annually. For example, the County will likely be required to prioritize watersheds and then to complete Water Quality Improvement Plans for two watersheds that have in excess of 1000 acres of impervious surface. The plans will identify potential projects to treat at least 3% of the untreated storm water in each watershed. Projects may include retrofitting existing BMPs, structural repairs to existing storm water infrastructure, adding BMPs to improve water quality, reducing redevelopment of impervious surfaces and improving stream segments. The plans must include a schedule for completing the projects and the projects must be completed pursuant to the plan and schedule.

#### **IV. STORM WATER BASIN RENOVATIONS**

In 2004, the County identified 74 storm water management ponds that had failed or were in the process of failing during routine inspections pursuant to its NPDES MS4 Permit. Failures were due to improper maintenance, poor design, or because they had reached the end of their approximately 20 year lifespan. Approximately \$10M was needed to rehabilitate these facilities. The County successfully garnered support from the State of Delaware and received \$8.9M in bond bill appropriations spread throughout fiscal years 2006 through 2008. Additionally, the County has allocated \$600,000 per year to this capital project. The Unified Development Code (UDC) now requires all new residential subdivisions pay into the long-term residential storm water escrow fund. These funds are to be used to offset the County's annual inspections and to compensate for the cost of future major maintenance.

On a parallel path, since maintenance plays a significant part in the proper function and lifespan of a storm water management facility, the County started the Storm Water Amnesty Program. This program provides County assistance with the major maintenance of residential storm water management facilities (defined as major sediment removal or structural repairs) in exchange for a commitment that the residential maintenance corporation registers with the County annually and performs routine minor maintenance and inspection of their facility. Today, 235 communities with multiple facilities are registered participants in this program, including facilities that were rehabilitated by the County.

As of today the list of 74 storm water management facilities needing major repairs has grown to 170, primarily due to facilities from the 80's now reaching the end of their lifespan. The County has performed major maintenance on 116 of these 170 with repairs ranging from the simple re-attachment of structural components to the complete re-engineering and rebuilding of

the facility to meet today's water quality standards. With the exception of a few projects held up with legal or permit issues, all of the most significant problems identified in 2004 have been addressed. 43 of the 54 remaining projects on the list are currently in the pipeline to be reconstructed, and the remaining 11 are on hold due to either legal property title issues or permitting issues. A list of the projects and their status is attached as Attachment A.

The storm water basin renovation projects have successfully eliminated many flooding problems. Subdivision streets that used to flood and yards that were inundated and/or eroded during rain events have successfully been remedied through these efforts. Harder to see but just as important, flow, sediment and pollutant loads to waterways have been reduced, which is consistent with the goals and requirements in the NPDES MS4 Permit.

## **V. STORM WATER MITIGATION PROJECT**

As a result of severe storms in the County in 2004, County Council passed Ordinance No. 04-176 (the "Ordinance") on January 11, 2005, to allocate \$17 million in bond funding for drainage and flood abatement projects at approximately thirty locations. The Ordinance provided funding for a wide variety of projects, including stream debris removal, engineering studies, buyouts of chronically-flooded homes and flood mitigation measures.

Additionally, the County, in a partnership with DelDOT, received \$1,933,761 in Federal funds to demolish seventeen flood-damaged homes in Glenville and to convert the remaining area to permanent open space. The federal money was added to the budget to make the total allocation for the Storm Water Mitigation Project \$18.99 million dollars.

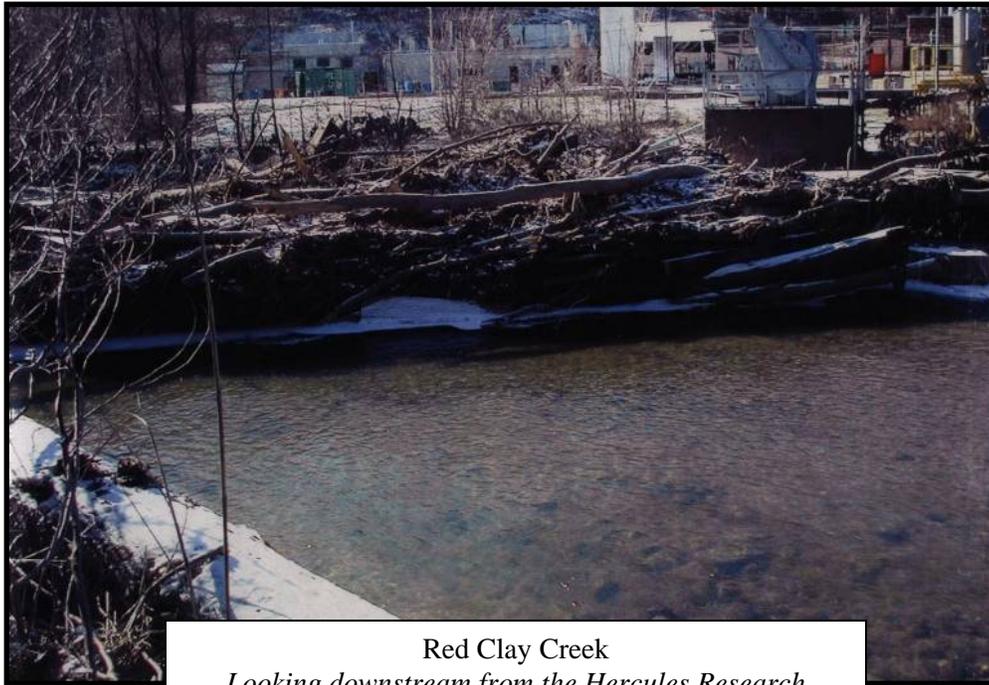
Because the Department was not staffed to manage all of these projects and because the Ordinance was based on unusual flood circumstance rather than ordinary conditions, the County partnered with the District on many of the projects. The District's expertise and resources were instrumental in managing the projects. With the District's involvement, the County was also able to benefit from additional funding through cost shares. It is estimated that a total of \$2,615,245 in State funds and at least \$3,745,116 in federal matching funds will be expended through cost-shares.

As of July, 2011, the County has completed 17 projects and has 13 in various stages of completion. To date, the County has spent \$14,737,104.00, including the Glenville project, and has encumbered \$1,769,451.31 for projects underway.

Descriptions of the projects follow.

### **A. Large-Scale Emergency Debris Removal from Streams**

Immediately after the Ordinance passed, the County awarded contracts to ten local construction firms to remove flow-blocking debris on three major watercourses: 1) Red Clay Creek; 2) Mill Creek; and 3) Hyde Run. The contractors removed 225 loads of debris/trash from 16,075 linear feet of stream. They cleared 11,600 of the 21,000 feet of Red Clay Creek; 3,225 feet of Mill Creek and 1,250 feet of Hyde Run.



Red Clay Creek  
*Looking downstream from the Hercules Research  
Center prior to clearing (December 2004)*

## B. Engineering Studies

The County retained consultants or worked with other agencies to perform hydrologic and hydraulic analysis of many watersheds and sections of watersheds. The studies defined projects which could alleviate flooding and drainage issues in the selected study areas. Many of the projects were then undertaken by the County, the federal government, State government, or private entities. The studies are described below. Many of the projects recommended by the studies are described in more detail in subsequent sections.

### 1. *White Clay Creek Watershed*

A detailed hydrologic and hydraulic analysis of the White Clay Creek watershed was conducted during 2007. A model of the watershed was developed to determine effective flood abatement improvement projects. The resulting project recommendations are summarized in Table V.B.1., below. Because they are all bridge-related projects, AMTRAK and DelDOT are responsible for their implementation. AMTRAK and DelDOT have not initiated any work on these projects to date.

<b>Table VI.B.1. - Recommended Projects</b>			
<b>Location</b>	<b>Flood Mitigation Recommendation</b>	<b>Priority</b>	<b>Preliminary Cost Estimate</b>
Red Mill Road Bridge	Increase floodway flow area through sediment excavation	1	\$127K - \$150K
	Remove in-channel sediment deposits	3	\$170K - \$600K
	Provide additional flow relief through embankment	6	\$2.5M - \$3M
Old Harmony Road Bridge	Increase floodway flow area through sediment excavation	2	\$510K - \$535K
	Remove in-channel sediment deposits	3	\$170K - \$600K
	Bridge demolition and removal; add walking paths.	7	\$400K - \$850K
CSX Railroad Bridge	Increase floodway flow area through sediment excavation	3	\$170K - \$193K
	Remove in-channel sediment deposits	3	\$170K - \$600K
	Provide additional flow relief through embankment	4	\$9M - \$10M
AMTRAK Railroad Bridge	Remove in-channel sediment deposits.	3	\$600K
	Provide additional flow relief through embankment.	5	\$9M - \$10M
Old Route 7 Bridge	Bridge demolition and removal.	7	\$400K - \$850K

## 2. Hyde Run Watershed

A conceptual hydrologic and hydraulic analysis of the Hyde Run watershed was completed. The watershed was comprehensively evaluated to assist in focusing flood abatement improvements along Hyde Run and its tributaries, particularly Coffee Run. Recommendations were made for the location of regional storm water management facilities and channel bank stabilization measures.

Based on this study, the County constructed storm water management basins at the Emily Bissell Hospital and Delcastle Recreation Area (see Sections V.D.3 and V.D.4, below). The facilities are upstream of many communities and provided noticeable improvements in drainage issues in downstream communities such as Duncan Glen and Hyde Park.

Additionally, the study proposed streambank stabilization measures along Hyde Run at Newport-Gap Pike and along Coffee Run in Westminster, in addition to proposed drainage improvements in Laurel Glen and Duncan Woods (see Sections V.F.4 and V.F.5, below).

The Coffee Run project will be completed in conjunction with the proposed sanitary sewer replacement project. The Laurel Glen and Duncan Woods projects will be undertaken and completed by the District once maintenance responsibility and easement issues are worked out with the numerous affected property owners. Some of the property owners have concerns with the maintenance and easements, which slowed the process.

### 3. *Calf Run Watershed*

A conceptual hydrologic and hydraulic analysis of the Calf Run watershed was conducted to develop flood abatement improvements along Calf Run and its tributaries. Recommendations were made for the locations of regional storm water management facilities and channel bank stabilization measures. These recommendations include:

- The proposed storm water management basin located on the former Army Reserve site at 3900 Kirkwood Highway. (See Section V.E)
- The streambank stabilization measures installed behind the properties in the 2400 block of Calf Run Drive in Truitt Farm. (See Section V.E)
- The streambank stabilization measures installed behind the properties in the 2300 block of Sherman Avenue in Kiamensi Heights. (See Section V.E)
- The streambank stabilization measures installed behind the properties in the 1000 block of Woodland Avenue in Marshallton Heights. (See Section V.E)
- The streambank stabilization measures proposed in Milltown Park and behind the properties in the 2400 block of West Eric Drive in Maplecrest. (See Section V.E)

### 4. *Back Creek Watershed*

The Back Creek study used a watershed approach to examine storm water quantity and quality issues as well as potential land development impacts on a 7.24 square-mile tract of land just south of the C&D Canal. The study involved the development of a working hydrologic watershed model that can identify existing flow-restricting infrastructure and can be utilized as a tool for comprehensive land use planning from a storm water management perspective.

The model indicated seven locations where roadway culverts may not be adequately sized to handle a twenty-five year rainfall event which is the current DelDOT design standard. The model also indicated five locations where pond embankment spillways may not be adequately sized to handle a one-hundred year rainfall event which is the current DNREC design standard. With continual use and timely updates, the hydrologic model can be used dynamically by engineers and land surveyors to simulate land development impacts on storm water runoff conditions within the Back Creek watershed.

The study also focused on water quality issues. Four reaches (or segments) of streams were recommended for bank stabilization improvements. Water quality retrofits were recommended for stormwater management ponds at sixteen locations within the Back Creek watershed. To enhance the land development process further, the study also identified areas in the watershed that would be most suitable for groundwater recharge, and recommended the development of riparian buffers in eleven specific areas.

### 5. *Caravel Farms Subdivision*

A study evaluated alternatives to improve drainage and reduce the potential for future flooding at Valerie Drive. Valerie Drive is a u-shaped road off of Mabel Lane in the Caravel

Farms East subdivision located west of Wrangle Hill Road (Delaware Route 7) and south of U.S. Route 40. The house at 9 Valerie Drive is situated at a lower elevation than the adjacent homes.

An engineering design of a solution to the flooding was provided. The designed improvements were constructed by the developer of the subdivision, R.C. Peoples, Inc., at no cost to the County.

#### 6. *DuRoss Heights/Airport Road Drainage Area*

A regional watershed study was completed for the DuRoss Heights/Airport Road area to estimate flood levels and identify solutions for flood mitigation with order of magnitude estimates of probable construction costs. The study revealed that many properties are low-lying and within a 100-year floodplain that is vulnerable to high tides. Recommendations included pursuing federal grants to flood-proof 78 properties, purchasing 24 properties, and performing timely maintenance to several DelDOT-maintained culverts. The total cost of these improvements would be over eleven million dollars.

#### 7. *Red Clay Creek Watershed*

A detailed hydrologic and hydraulic model of the Red Clay Creek was funded by the State, developed by a consultant for the County, and submitted to FEMA. The development of this model was part of a larger study currently in progress by the Army Corps of Engineers that addresses flooding and environmental concerns throughout the watershed. The model can also be used to predict the effectiveness of future flood control projects proposed within the watershed. Projects recommended by the study could be eligible for Federal funding and completed by the Corps. The model will also be utilized by FEMA and local agencies when processing Letters of 100-year Floodplain Map Revisions (LOMRs) in connection with new development and/or re-development projects.

#### 8. *Mill Creek Watershed (Hickory Hill and Southwood Areas)*

The purpose of this project was to study a portion of the Mill Creek watershed from its headwaters at the Pierson Ridge subdivision along its frontage with the Hickory Hill and Southwood subdivisions to Brackenville Road. This included investigating the feasibility of utilizing the existing land features to construct a storm water management facility that will retain run-off flows from Pierson Ridge. The NCCD undertook the study and funds remaining after the study can be used for small-scale streambank stabilization measures in the Hickory Hill and Southwood subdivisions in addition to other recommended projects.

### C. Buyouts of Chronically-Flooded Homes

The Ordinance funded the buyout of several flood-prone properties. Once purchased, the dwellings were demolished and the properties were transformed into open space areas. Some of these areas remained under County ownership, while others were annexed by the adjoining property owners.

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The County evaluated twenty-nine formal applications. which resulted in twenty-two purchases. Properties were prioritized and selected for purchase based on how well they met the following criteria:

- Vacant at the time of the evaluation;
- Severe structural damage;
- Extensive flooding history and future flooding potential;
- Health and/or safety threat; and finally,
- Removal of the dwelling had to be consistent with regional improvements.

Nine of the twenty-two properties were purchased with the assistance of FEMA grants. There is currently one home purchase pending the receipt of FEMA funds. Table V.C describes the twenty-two purchase. Pictures of two of the properties (Marshallton and Yorklyn) illustrate the degree of flood damage in the bought-out homes.

<b>Table V.C. - Properties Purchased by New Castle County</b>			
<i>( * with the assistance of FEMA funds)</i>			
<b>Subdivision</b>	<b>Address</b>	<b>Subdivision</b>	<b>Address</b>
Glendale II	21, 23, 25, 27, 29, 31, and 33 Perpen Court	Newkirk Estates*	120, 121, 122, 123, 125, 127, 132, and 134 Longview Drive
Marshallton*	905 Kiamensi Road	Yorklyn	807 Mt. Cuba Road
Westfield	12 Cypress Avenue	Christiana Acres	331 Airport Road
Rutherford	155, 157, and 159 West Rutherford Drive	Cooper Farm* <b>(PENDING)</b>	3418A Faulkland Road

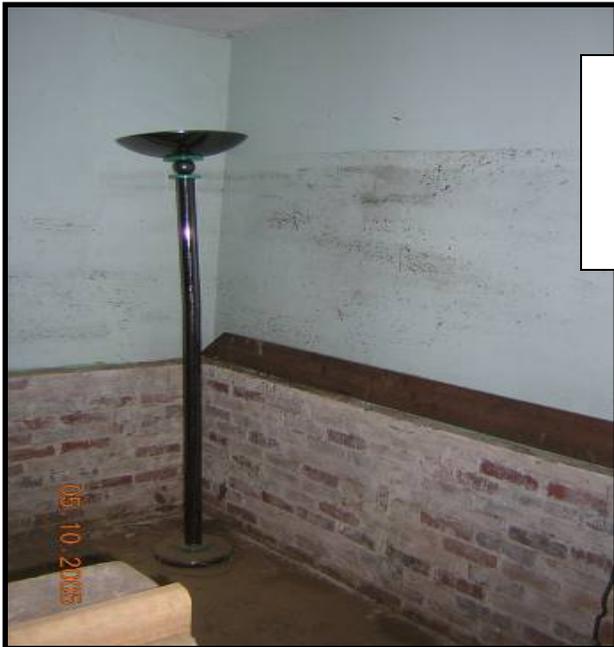
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905 Kiamensi Road,  
Marshallton  
*Impacted by  
Red Clay Creek*



905 Kiamensi Road,  
Marshallton  
*Undermined stone  
foundation*



905 Kiamensi Road, Marshallton  
*Interior damage  
Note: see water line 80" above  
finished floor*

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807 Mt. Cuba Road,  
Yorklyn - *Impacted by  
Red Clay Creek*



807 Mt. Cuba Road, Yorklyn  
*Garage wall with temporary supports*

807 Mt. Cuba Road, Yorklyn  
*Basement wall collapse*



D. Storm Water Management Enhancement

Storm water management facilities were constructed and/or enlarged at several locations. These facilities provide upland storage of flood waters to prevent excessive flows during heavy rainfalls which cause flooding of properties and erosion of streambeds downstream. Many of the facilities were recommended by the studies described in Section V.B., above. Before and after pictures illustrate improvements.

The following are facilities that were constructed:

1. *Glendale II Subdivision*

This facility was constructed on a tract of land that once contained seven flood-damaged dwellings. The dwellings were demolished and a dry storm water basin was constructed on the remaining land to provide for the additional storage of floodwaters to protect the remaining homes in the Glendale II subdivision. There have been no flooding complaints received from the residents of Glendale II since this facility was constructed in 2007.



Glendale II  
*Flooding in  
September 2004*

Glendale II  
*New detention  
basin*



2. *Old Hobson Farm Subdivision*

The embankment for this pond collapsed due to the heavy flows from Hurricane Jean in the fall of 2004. The resulting debris caused further damage to the adjoining property immediately downstream at 110 Willow Spring Road. Repairs to the facility were made in the fall of 2005, and the property at 110 Willow Spring Road was restored in the spring of 2009. Ownership of this basin could not be determined, so the County has assumed the maintenance responsibility. There have been no flooding complaints received from the surrounding properties since the completion of these improvements.



Old Hobson Farm  
*Immediately after  
Hurricane Jean  
Fall 2004*



Old Hobson Farm  
*Newly-constructed  
embankment and  
principal spillway*

3. *Emily Bissell Hospital*

A regional storm water basin with a 5.8 million gallon storage capacity was constructed on a six-acre tract of land on the grounds of the Emily Bissell Hospital. The facility has enough storage to reduce the peak flows developed downstream in Hyde Run during a 100-year rainfall event by approximately 50%. There have been no flooding complaints received from property owners situated downstream since this facility was constructed in 2007.

Emily Bissell  
Hospital  
*Completed facility*



4. *Delcastle Recreation Area*

The storage volume of an existing basin at the Delcastle Recreation Area was expanded by 1.1 million gallons. This additional storage reduced the peak flows developed downstream in a tributary of Hyde Run during a 100-year rainfall event by approximately 50%. This tributary was the source of repeated flooding in the Duncan Glen subdivision located directly downstream. There have been no flooding complaints received from property owners situated downstream since this facility was constructed in 2007.



Delcastle  
Recreation Area  
*Original basin*



Delcastle  
Recreation Area  
*Expanded basin*

### 5. *Army Reserve Site*

Flood Ordinance Program funds have been used to study the feasibility of constructing a storm water management facility at the former Army Reserve site located off of the 3900 block of Kirkwood Highway. The detailed engineering design and construction of this facility is contingent upon a 21<sup>st</sup> Century Fund cost-share with the State. The District is currently working on the preliminary design.

#### E. Streambank Stabilization

As a result of the studies described in Section V.B., several areas of eroded streams were stabilized. The stabilization measures prevent eroded soils and debris from entering the stream and causing downstream blockages. Some measures also protect nearby structures.

Completed streambank stabilization projects include:

- 2400 block of Calf Run Drive, Truitt Farm
- 2300 block of Sherman Avenue
- 1000 block of Woodland Avenue
- 400 block of Way Road
- 2200 block of St. James Drive, Penn Drew Manor
- 100 block of Willow Spring Road

Still to be completed stream bank stabilization projects include:

- Brookside Drive: this project, part of the Little Mill Creek Phase II Flood Control Project described in Section VI, is currently underway and is being managed by the Corps.
- Maplecrest (County parkland off West Eric Drive): this project, contingent upon the receipt of State funding, is being managed by the District and currently underway.
- Coffee Run (off Coffee Run Lane in Westminster): this project will be completed in conjunction with a proposed sanitary sewer replacement project which is currently in development.
- Hyde Run at Newport-Gap Pike (former Dallas Property): this project is being managed by the District and is currently underway after delays caused by property ownership changes.
- Rosemont Drive (pending State funds, replaced Marshallton project): this project, being managed by the District, will begin as soon as the necessary cost-share funds are received from the State.
- Talbot Drive (replaced Coventry project): due to property-owner concerns with a proposed project in Coventry, Council voted to move funds to Talbot Drive. This project, being managed by the District, will begin as soon as the necessary cost-share funds are received from the State.

Before and after pictures for some of the completed stabilization projects follow.

**2400 Block of Calf Run**

**BEFORE**



2400 Block of Calf Run  
Drive, Truitt Farm  
*Stream erosion after  
September 2004*

**AFTER**



2400 Block of Calf Run  
Drive, Truitt Farm  
*Streambank stabilized  
with gabions*

**2300 Block of Sherman Avenue**

**BEFORE**



2300 Block of Sherman Avenue  
Streambank condition  
prior to mitigation

**AFTER**



2300 Block of Sherman Avenue  
After streambank  
stabilization



**1000 Block of Woodland Avenue**

**BEFORE**



1000 block of  
Woodland Avenue  
*Stream channel  
prior to mitigation*

**AFTER**



1000 block of  
Woodland Avenue  
*Stream channel  
after stabilization*

**400 Block of Way Road**

**BEFORE**



400 block of Way Road,  
Owls Nest  
*Streambank erosion*

**AFTER**



400 block of Way Road,  
Owls Nest  
*Stabilized streambank  
after mitigation*

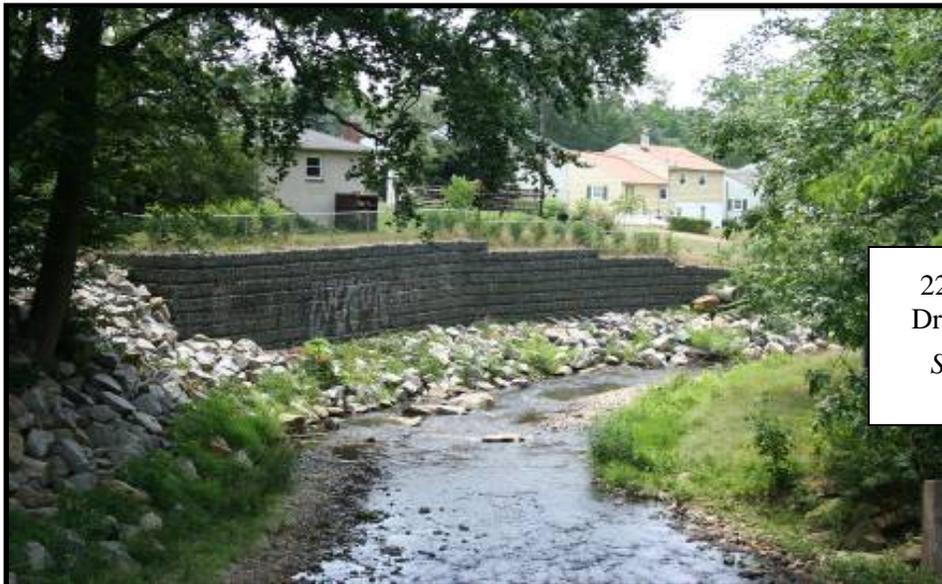
**2200 Block of St. James Drive**

**BEFORE**



2200 block of St. James  
Drive, Penn Drew Manor  
*Pre-mitigation erosion*

**AFTER**



2200 block of St. James  
Drive, Penn Drew Manor  
*Stabilized streambank*

F. Drainage Improvement Projects

As a result of the studies described in Section V.B., several drainage improvement projects were completed in residential areas. These projects involved the construction of storm sewers, drainage swales, catch basins, and the enlargement of existing roadway culverts.

Following are some examples of completed projects.

1. *Academy Hill*

Flooding had been reported in the vicinity of 9 and 11 Oklahoma State Drive likely related to spring activity between these houses and a possibly undersized catch basin in the roadway. The solution involved the construction of a swale and lawn basin discharging into the existing community storm water management system.



Academy Hill  
*Drainage improvements  
including swale and lawn  
basin*

## 2. Hawthorne/Montgomery Woods

Significant flooding has been experienced by low-lying properties near the end of Montgomery Woods Drive in Hockessin. Much of the flood water originates in the up-gradient Hawthorne subdivision. This project consisted of reviewing the existing two storm water management facilities in Hawthorne, and evaluating if they could be enhanced to significantly reduce down-gradient flooding. It was determined that the flooding could be alleviated by adding an additional roadway culvert that conveys storm water away from the affected properties without increasing flooding to downstream properties.

### BEFORE

Hawthorne/Montgomery  
Woods  
(off Montgomery Drive)  
*Before improvements*



Hawthorne / Montgomery  
Woods (off Montgomery  
Woods Drive)  
*After improvements and  
stabilization*

### AFTER

### 3. *Meadowdale*

This project provided flood relief along Cardiff Court in Meadowdale. The District designed and managed the construction of a storm drainage system with under drains that minimized flooding in the rear yards of many properties in the subdivision.



Meadowdale (Unit block of East Cardiff Court)  
*Drainage improvements*

### 4. *Laurel Glen*

As a result of watershed studies, flood abatement improvements have been designed for the Laurel Glen area. Approximately 1,100 feet of existing storm sewer pipe and related infrastructure will be upgraded to improve drainage. The construction phase of this project is currently being managed by the District and is underway.

### 5. *Duncan Woods*

Flooding has been observed at Squirrel Hill Court in Duncan Woods between Duncan Road and the Anna P. Mote Elementary School. Squirrel Hill Court slopes fairly steeply away from Duncan Road to a low point, then steeply up to the cul-de-sac for the homes that back up to the school. Storm water runoff overloads the low point during heavy rainfall. A drainage study of this area indicated that some pipes and/or inlets are undersized. The scope of this project is to upgrade approximately 200 feet of existing storm sewer pipe and related infrastructure such as catch basins near Squirrel Hill Court. Engineering design has been completed and NCCD will manage the construction of the proposed improvements. This project is currently underway.

G. Glenville

In 2004, the County and DelDOT each appropriated \$15M to purchase and demolish 174 flood-damaged properties in the Stanton Crest and Glenville subdivisions. This work, completed by DelDOT with contracted forces, also included the removal of over 6,100 linear feet of roadway. The remaining land was re-graded and converted to wetlands to enhance storm water quality and to help prevent the flooding of the remaining 25 residential properties.

The County, in partnership with DelDOT, applied for and received three FEMA flood mitigation grants in 2007 totaling \$1,933,761 to help reduce the financial burden of this project. This money went into the Storm Water Mitigation Project budget, but was used for the County to purchase the development rights to seventeen properties within these subdivisions that had been recently purchased by DelDOT. Along with taking control of the development rights for these parcels, the County agreed to place a restrictive land use covenant that will ensure that these parcels remain permanently as open space.

**VI. Little Mill Creek, Phases I and II**

Little Mill Creek Phases I and II were initiated prior to the Ordinance funding the Storm water Mitigation Project. A brief summary of the projects follow.

A. Phase I

This project, which was funded by the Corps and local money, called for specific improvements along more than 2,300 feet of Little Mill Creek near Elsmere to reduce the frequency of flooding. Phase I encompassed the Kirkwood Highway aqueduct to the north, and the Wilsmere rail yard to the south. Specific improvements included brush removal, re-grading of the embankments with the installation of toe reinforcements, stabilization of areas below the ordinary high water elevation, installation of flow-controlling vanes, and the planting of vegetation and trees. The County contributed \$911,000 to Little Mill I, but the majority of the project was funded by the Corps and the District. The Corps was responsible for construction, which was completed in 2008. No flooding complaints have been received from residents since the project was completed.

B. Phase II

Phase II is also being led by the Corps, with the District and the County sharing in funding and other tasks such as easement acquisition. The limits of the project are the Maryland Avenue aqueduct to the north and the Amtrak railroad culvert to the south. A preliminary design is currently in progress by the Corps. A total of \$483,000 in County funds has been allocated toward this project. The County's contribution will be matched with approximately \$550,000 in State funds, and approximately \$2,700,000 in Federal funds. A timetable for construction has not been finalized.

## **VII. Path Forward**

The County is involved in a diverse array of storm water and drainage work. In today's regulatory environment, it is clear that the County's responsibilities will continue to increase. While over the past decade the County has been involved in a wider range of projects, including residential buyouts and major flood mitigation projects, the two areas where the County has clear legal responsibility are 1) keeping non-tidal waterways free flowing and 2) compliance with its NPDES MS4 Permit and the related federal consent decree.

Given the increased regulatory requirements likely in the new NPDES MS4 Permit, it is recommended that the NPDES MS4 Permit become the guiding document in determining future storm water and drainage projects. By tying such projects to the permit, the County can best ensure that available funding supports regulatory-mandated programs. Further, it would ensure that future storm water and drainage funds, including any funds remaining in the Storm Water Mitigation Project, are spent on projects that have the largest positive benefit to the environment. By studying and focusing comprehensively on watersheds, the County could better address flooding and water quality issues.

It should be noted that drainage projects outside of keeping waterways open and free-flowing and outside the scope of the NPDES MS4 Permit are subject to the qualification criteria set forth in Article 7, Chapter 12 of the *County Code*. The relevant sections of Article 7 are set forth below.

### **Sec. 12.07.001. Qualification criteria.**

- A. Improvements to public and communal watercourses, drainage systems and storm water management basins by New Castle County shall only be made:
  - 1. To protect persons and property (specifically buildings) from serious harm and significant damage from flooding caused by storms of up to one hundred (100) year frequency;
  - 2. To protect a dwelling unit(s) or attachment building from structural damage because of flowing water;
  - 3. To eliminate a public health hazard certified as such by the State Public Health Officer, provided other methods are not available or practical to eliminate the health hazard.
- B. Inundation of yards and/or periodic basement flooding are not considered significant damage. Ponding and/or failure of a lot to drain is not the responsibility of the County.
- C. Improvements made with bond revenues must have a useful life of at least ten years.

12 N.C.C.C. § 12.07.001

### **Sec. 12.07.002. Approval procedure.**

- A. The following approval procedure will be followed for stream and watercourse improvements; however, every effort should be made with a minimal expenditure, to determine if County Council will approve the project, before any further study or expenditure.

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1. A study will be made to establish and map the floodplain and delineate the wetlands along the watercourse.
2. A typical cross section of the improvements will be developed showing approximate widths, depths and type of construction.
3. Order of magnitude costs for proposed improvements will be developed.
4. A public hearing will be held with those property owners adjacent to the watercourse to obtain their comments regarding the drainage study and the proposed improvement(s).
5. An informal meeting will be held with County Council to reach a consensus concerning proceeding with project development and a determination will be made to proceed or abandon the proposed improvement(s).

12 N.C.C.C. § 12.07.002

The County may be periodically approached by the District or the Corps to cost-share in State or federally-managed projects. While most storm water and drainage projects should be based up the NPDES MS4 permit, these cost-share projects may be worth considering to obtain State and federal funding assistance. Any potential County contributions to such projects should be evaluated and approved pursuant to the applicable sections of the approval process described above and set forth in Article 7, Chapter 12 of the *County Code*.

Once the County receives its new NPDES MS4 Permit, the Department will prioritize watersheds and determine the two watersheds which will be the focus of studies and improvement plans in the next permit cycle based. The Department will brief Council on the new permit and the watershed study process. EPA's goal is to cover all of New Castle County's watersheds over the course of several permit cycles. Following the EPA's plan to address storm water and drainage issues on a watershed basis will ensure that funds are focused on projects that provide comprehensive solutions and the greatest environmental benefit.