

Chester Town Stormwater Assessment Draft Final Report Chester River Association

Introduction

In today's urban environments, stormwater has the potential to severely impact surface waterways by both chemical and physical means. The contaminants associated with typical stormwater runoff are products of the characteristics associated with urban or rural land use. The physical impacts of stormwater are directly related to the magnitude of urban or impervious areas close to surface waterways. Studies have shown that higher density, urban areas contribute far more pollutants and impact the physical dynamics of streams than do lower density urban areas. Chestertown can be classified as a small urban hotspot in an agriculture landscape.

Chestertown is located on Maryland's Eastern Shore where agriculture dominates the countryside. Nutrient impacts to the Chester River from stormwater runoff, is a key component to the degradation of water quality and habitat for SAV's, crabs and shellfish. The goal of the Chestertown Stormwater Assessment project is to assess water quality impacts to the Chester River and Radcliffe Creek from the Chestertown stormwater drainage system. The assessment was geared to look at quality and quantity, with a range of parameters from nutrients and metals to bacteria. The following is a report on the findings of this project with recommendations for improvements.

Tasks and General Design of the Project

The Chestertown Stormwater Assessment project was designed to estimate any significant impacts to Radcliffe Creek or the Chester River from the town of Chestertown. Chestertown is a historical town with 300 years of history and urban additions with little

improvements. As development over the years has occurred and guidelines from the state and local level have developed, a greater emphasis has been on limiting the impacts to natural waterways. Public sewer and water lines were put in, but only minor improvements in stormwater were completed. The majority of stormwater flow is captured and routed using the curb and gutter system. Other areas have put in storm-drains and collection basins, but then routed to the same curb and gutter system. Many of the historical areas still have connected roof drains that lead directly into the street. The tasks outlined below were an attempt to quantify the impacts of this unique mixed system.

Locate Critical Drainage Outlets

The first task was to research and locate all inlet and outlet drains, to determine drainage area and locate the more critical outlets. This was done in three stages:

1. Map the existing town perimeter and divide the town up into zones for easier data collection and analysis.
2. Collect data including GPS position of every storm drain and outlet, potential water path and any other topographic information that would help in estimating drainage areas.
3. Locate stormwater designs and plans from the Town of Chestertown to help connect drains to finalize drainage areas.

Once the town was mapped and divided using GIS Arc View, 25 zones were assigned for volunteers to ground truth using a GPS and maps of the individual zones. The maps were used to verify GPS coordinates in case of inaccuracies. The information collected was analyzed and general drainage areas began to emerge. Since many of the outlets were not accessible from a road, therefore kayaks were used to investigate potential areas for outlets. Three trips were conducted up Radcliffe Creek and along the shoreline of Chestertown on the Chester River. When all the information was

collected, the critical outlets were determined. A critical outlet has several characteristics:

- The potential drainage area has to be of significant size compared to all other drainage areas.
- The drainage outlet has to be a direct discharge to a surface water body. Drainage areas that discharge into a wetland area do not qualify.
- The outlet drains a suspected pollution source.
- The urbanization of the drainage area must be significant, compared to all other drainage systems of the project area.

Collect Water Quality Data

When the critical outlets were determined, a sampling plan was developed. After discussion with the Science and Tech Committee, guidelines for the water-monitoring phase were established. The guidelines were to be used as a guide in constructing a Quality Assurance Plan, which provides for a scientifically valid project and usable information for the Town of Chestertown. The guidelines were:

- Use the Standard Operation Procedural manual developed for the Chester Tester Monitoring program.
- Sample the critical outlets during 5 to 10 storm events.
- Utilize LaMotte tests and testing equipment for in-house analysis.
- The parameters tested will be a combination of nutrients, metals and bacteria. They include:
 - Nitrate-Nitrogen
 - Ammonia-Nitrogen
 - Phosphates
 - Phenols
 - Detergents

- Lead
- Iron
- Copper
- Cadmium
- Chromium
- Fecal Coliform Bacteria
- If results from the first analysis prove to be critically high, then out source sampling to an outside lab.
- Reduce cost of the project by collecting grab samples during the “first flush” part of the rain events. This will capture the more critical pollutants that may impact the river.
- Calculate flow using a Global Water Flow meter.

Analysis Results

The critical outlets and general drainage areas were defined after the data and information was collected from the volunteers, the discussions with the Town Manager and the review of plans and designs were assessed. There are several outlets that drain various parts of Chestertown to the Chester River and Radcliffe Creek. During the analysis, 17 sites were identified as stormwater outlets, but only three sites qualified as a critical outlet that would be included in the water quality analysis. Several development projects within the Town of Chestertown have on-site stormwater management facilities, such as wet and dry ponds, sand filtration and wetlands or bio-retention ponds.

The Project time line was from April through June of 2006. With a relatively dry winter, conditions seemed perfect for collecting samples during the Spring. However, only two events occurred with greater than 1” of rainfall. This was a small set back in the ability to collect water samples and estimate water flow to calculate a loading potential. Water flow is critical in calculating the volume of water that passes the measuring point over a period

of time. This information with the results from a water quality test estimates loading potential or quantity of pollutants. Spring of 2006 has also proven to be under drought conditions. Only one rain event provided sufficient water for collecting samples, and that was not great enough to estimate flow.

The drought conditions also introduce an extreme component into the water quality analysis. With a long drought period, a greater amount of pollutants can build on impervious surfaces. Pollutants come from cars, animals, and fertilizers and most importantly from the atmosphere. The Eastern Shore is in the direct air flow path from the western shore where several coal fired power plants emit levels of smog that contain high amounts of nitrogen, sulfur and particulate matter. All these sources over time can build up on impervious and pervious surfaces. When there is sufficient rainfall, the “first flush” occurs and typically has higher pollution concentrations. The following information is based on one set of samples collected and is in no way a scientifically valid conclusion, but can be used to understand and estimate the potential for impacts from stormwater.

Nutrients

Nutrients are necessary for the growth of aquatic plants, which in turn increase habitat and food source for all aquatic species. Though excessive amounts can actually degrade habitat and create conditions that are toxic to most aquatic species. Among the nutrients that are most commonly measured are nitrates and nitrites, ammonia, and phosphates. These are typically measured in total nitrogen and total phosphorus. The tests that this project used are ones that measure dissolved. Ammonia- Nitrogen is extremely toxic to aquatic life as well as nutrient loading that fosters algae growth and in warm temperatures can result in toxic algae bloom die-offs. Phosphorus is also a nutrient component that is attributed to algae blooms and is typically considered the limiting nutrient.

This means that phosphorus is the controlling factor for the growth of excessive algae. Under the right conditions, large algae blooms will die off and severely reduce dissolved oxygen.

Site CT1

The site CT1 is located at the end of High St. and discharges directly into the Chester River. Many side streets in the urban historical area direct stormwater to CT1 by means of curb and gutter, storm drain pipes and gutters connected to roofs. High St. is one of the main arteries for the town with commercial and residential development. The discharging pipes empty into a concrete trough that runs about 200ft and empties into the Chester River. The drainage area is the largest for the Town of Chestertown and is approximately 95% impervious surface.

Site CT1 water quality test results show extremely high concentrations of ammonia-nitrogen and orthophosphates. Ammonia-nitrogen was 80 times higher than what is typically found in natural waterways and orthophosphates at least 20 times higher. Nitrates were lower than most natural streams in the Chester River watershed. Bacteria were measured and no fecal coliform or E. coli was present in the incubated samples.

Site CT2

Site CT2 is located on the east side of town and drains the second largest area of Chestertown. The exact drainage area was not determined due to a lack of plans and designs that are essential in delineating the connection between stormwater inlets. A general drainage area was determined based on flow patterns and topography. Site CT2 drains into a historic stream that has been rerouted and covered with pipes and parking lots. The only portion of the stream that is left is a 50 ft section that drains into the Chester River. Two small side street curb and gutter systems

contribute to the stormwater flow. The drainage area is also a combination of curb and gutter, storm drains and pipes with an approximate 90% impervious surface.

Nitrate-nitrogen was low, but ammonia-nitrogen and orthophosphates were still high in comparison to natural stream concentrations. Ammonia-nitrogen was 30 times higher and orthophosphates were 16 times higher than in natural systems. Bacteria tests resulted in no significant levels of fecal coliform or E. coli.

Site CT3

Site CT3 is located on the north end of Chestertown and drains the north side of High St and discharges into Radcliffe Creek. The drainage area is the fourth largest and is only approximately 75% impervious surface. The drainage area is in the more recent developed areas of Chestertown and has mainly a storm drain system. Radcliffe Creek runs along the western border of the town limits and drains primarily agricultural areas. However, in recent years there has been a boom of residential housing with on-site stormwater systems that discharge into Radcliffe Creek.

Ammonia- Nitrogen was relatively high for natural waters, about 20 times higher, and orthophosphates were 5 times higher. Nitrates were also low and bacteria results were also negative.

Metals and Other Parameters

Besides nutrients, various metals and other key indicators of urban contaminates were measured. These include lead, copper, cadmium and iron as metals; phenols, pH, detergents and total dissolved solids as indicators for other hazardous contaminates. There were no significant levels of metals or indicators that may point to other pollution impacts.

Recommendations

The following recommendations are in two parts: general and site specific. The general recommendations are those that the town of Chestertown can take into consideration. The site specific recommendations are those that can be accomplished by the town or other interested groups and target changes to the critical and non-critical stormwater outlets that will reduce impacts to the Chester River.

General

- Develop information brochures on stormwater and the general impacts to waterways.
- Encourage the use of rain barrels – seek decorative type barrels that will fit in with the historic nature of the town.
- Paint all stormwater inlets with signs or markings that indicate “No Dumping”.
- Monitor sites during wet seasons.
- Assemble and store all stormwater plans and designs with the town of Chestertown. This would allow for a better judgment by the town with new development and the potential impacts to the existing system.

Site Specific

- Seek professional advice on all stormwater retrofits.
- Site CT1:
 - Remove bottom of concrete trough and replace with grass swale or other natural medium. This would allow for the uptake of nutrients and reduce turbidity during the “first flush” of each rain event.
- Site CT2

- The small stream reach that the outlet discharges to can be retrofitted with a bioretention/wetland that accommodate the “first flush” volume with a weir outlet during high flow events.
- Site CT3
 - An in-ground sand filtration stormwater containment structure could be utilized to filter the “first flush” volume.
- Non-critical outlet RC1
 - The current stormwater management pond needs to be retrofitted to reduce transfer of pond water with that of Radcliffe Creek during high tide.

CT2

RC1

CT1

Figure

The critical outlets are marked in red. The blue marks represent outlet points that were not attributed to a specific development project.