Characterization Of An Urban Stream For Stormwater Control
A Baseline Study On The Campus of Penn State Harrisburg

Christina Y. S. Siu, Dr. Katherine Baker, Dr. Shirley E. Clark
Environmental Pollution Control Program
Penn State Harrisburg, Middletown, PA 17057

Introduction
Stormwater runoff is usually given little consideration until excess water floods onto roads and homes instead of being completely captured by storm drains. In addition, people do not realize that runoff is not treated before it reaches natural waters. Aside from deliberate dumping of waste into these storm drains by humans, stormwater runoff contains many pollutants from road surfaces, lawns, and even car washers. As a result, urban water quality and habitat quality are threatened due to stormwater runoff.

One such urban stream is located on the campus of Penn State Harrisburg. It begins underground as stormwater collection pipes that feed the above-ground section of the stream at various points along its length. Historical water quality data does not exist for this stream. This study examined the water quality of the stream for six months, including periodic visual-based habitat assessments. This dataset will form baseline data for the stream and provide a reference for impacts from future campus development.

Methodology
- Water samples were taken both after storm events and during base flow conditions from September 2005 to March 2006 at four different locations along the stream (headwaters, midstream, and downstream).
- Samples were analyzed for their phytochemical properties (specific conductance, turbidity, and nutrients) using EPA approved methods.

Results and Discussion
- Nutrients (nitrate, phosphate) indicate pollution sources such as lawn fertilizer, animal/bird wastes, and/or poorly treated to untreated human waste.
- Nutrient concentrations were approximately ten times higher (0.4 mg/L – 5.1 mg/L) than phosphate concentrations (0.03 mg/L – 0.58 mg/L).
- Environmental factors, such as rainfall, affect certain measures for water quality assessment, including turbidity and specific conductance.
- Higher turbidity occurred during 0.1 inches or less of rainfall and lower concentrations occurred for >0.5 inches of rainfall, indicating a likely dilution of suspended matter with a greater volume of water. This is opposite of what usually occurs in urban streams.
- Conductivity measurements indicate the amount of dissolved ions present in water.
- Base flow conductivities are higher than storm flow indicating a stream source that is diluted during rain events.
- Storm flow and base flow both show a decrease in conductivity from the headwaters toward downstream, indicating the source of dissolved ions is at or above where the stream daylights.

Conclusions
- Environmental factors, such as rainfall, affect certain measures for water quality assessment, including turbidity and specific conductance.
- Nutrate and phosphate have seasonal sources, with greater nitrate seen in the winter and greater phosphate in the summer.
- Certain physiochemical properties (specific conductance and turbidity) were measured differentially.
- Species diversity and populations are small and the ephemeral nature of the stream stresses those organisms that live in the stream.

Areas For Future Research
- Determine the sources of nitrate and phosphate fertilizer, sewer/septic tank leakage, etc., and the relationship of these sources to the specific sampling site. This will require detailed outfall and stormdrain sampling at times corresponding to activities such as campus fertilizer application.
- Evaluate if the foaming problem is a natural occurrence.
- Test outflows of different pipes along the stream to gain a better understanding of what constituents flow in each pipe and demonstrate what portion of the stream it affects.
- Analyze the fate and transport of these pollutants in both the piping and stream systems.
- Examine microbiological quality of stream to see if there are correlations with chemical quality.
- Assess storm impacts resulting from the growth of Penn State Harrisburg and compare to the results of this study.

Acknowledgements
I want to thank the EPC Program for the graduate assistantship that partially funded this study. Thanks go to Dr. Katherine Baker and Dr. Shirley Clark for their guidance and support and to Julia Halco, Jimmy Jaquez, Brett Long, Brad Mikula, and Ed Spayed for field assistance.